Link #	Site 1 Name	Site 2 Name	Radio Model	Annual Availability (%)	Outage (sec/yr)
6	Bushnell Water Tower	Rutland	MX/I/6G/157MB/30M/HP	99.99926%	232.90
7	Rutland	Wildwood PD	MX/I/6G/157MB/30M/HP	99.99975%	78.10
8	Wildwood PD	Villages Water Tank	MX/I/6G/157MB/30M/HP	99.999996%	1.22
9	Wildwood PD	Dispatch Center	MX/S/18G/105MB/30M/HP	100.00000%	0.00
System Availability				**99.999999944%**	**0.02**

The microwave network design provides full Layer-2 switch capabilities, on a bandwidth that exceeds SONET throughput on a 30 MHz channel. Each link is currently configured for Ethernet, with four 10/100/1000 Gigabit Ethernet ports per radio. The proposed ASTRO 25 system requires the following bandwidth between specific sites:

- 350 kbps – Prime site with 8TAC to Master site.
- 2 Mbps at 100% utilization – MCC 7500 Dispatch site (Wildwood PD) to Master site.
- 1.750 Mbps – 5 Remote simulcast sites with 8TAC to Prime site.

The proposed microwave system operates in a Layer-2 ring configuration, at any given time a link could fail and all data will be routed over any link. Therefore, the bandwidth required by the proposed system is 4.1 Mbps. This provides plenty of room for growth leaving over 150 Mbps available for future needs (Table 4-9: System bandwidth).

Table 4-9: System bandwidth

Link #	Site 1 Name	Site 2 Name	Link Bandwidth (Mbps)	ASTRO 25 Bandwidth Required (Mbps)	Available (Mbps)
1	Villages Water Tank	Sumterville	155	4.1	150
2	Sumterville	Sumter Sheriff's Office	155	4.1	150
3	Sumter Sheriff's Office	Linden American Tower	155	4.1	150
4	Linden American Tower	Wilsons Corner	155	4.1	150
5	Wilsons Corner	Bushnell Water Tower	155	4.1	150
6	Bushnell Water Tower	Rutland	155	4.1	150
7	Rutland	Wildwood PD	155	4.1	150
8	Wildwood PD	Villages Water Tank	155	4.1	150
9	Wildwood PD	Dispatch Center	105	4.1	100
System Growth %					**3659%**

Some of the key features of this microwave network are:

- Industry-leading System Gain.
- Full Layer-2 Ethernet Switching.
- Native T1 and Native Ethernet (minimal latency).
- High Bandwidth Efficiency.

- 4 GigE and Fast Ethernet Ports (expandable as required).
- Built-in SNCP and RSTP, to allow for ring protection for T1 and Ethernet without the use of external routers or switches.
- Adaptive Coding and Modulation (ACM).
- Full Quality of Service (QOS) and Class of Service (COS) Functionality.
- Full OA&M Functionality.
- Software-capable Expansion.

Power for the microwave system will be provided by redundant -48 VDC rectifier plants, which have been included at each of the locations. To provide continued operation of the microwave equipment, in the event of a power outage, each of the locations will also include a standby battery system sized for 24 hours of operation. An automatic low-voltage disconnect system will be utilized to protect the battery plant from deep-cycle discharge damage.

The microwave system has been designed for ease of testing, troubleshooting and repair of network components. Network Management and alarming of the microwave system will be integrated into the overall Network Management of the radio network, but may also be made available at a separate server dedicated to the microwave system. A set of microwave equipment spares has been included with the system, to provide for quick replacement of equipment failures. An Orderwire channel will be available on the microwave network and an Orderwire handset has been included at each microwave radio site, to further aid technicians in the testing and troubleshooting of the network.

The proposed solution, which is fully compliant with the requirements of Sumter County, consists of a hot standby spur and loop protected microwave installed within the equipment shelter connected to tower mounted dishes by elliptical waveguide. All loop radios are hot standby configuration.

The following equipment is included in each loop microwave link:

- 16 Digital Microwave 6 GHz Radios – (8 Loops).
- Loop Radios Equipped for Hot Standby Operation.
- 4 Gigabit Ethernet Interfaces per Radio.
- Configured for Orderwire Operation (Handset Included).
- 7-foot, 19-inch Equipment Rack.
- 14 6-foot Dish Antennas.
- 2 8-foot Dish Antennas.
- Flexible Waveguide.
- Waveguide Accessories:
  - Connection Adapters.
  - Hanger Kits.
  - Grounding Kits.
  - Entry Boots.
  - Dehydrators.

- -48 VDC Rectifier Plant (Independent of RF Infrastructure):
  - 7-foot, 19-inch rack.
- Battery Plant:
  - Sized for 24-hour Equipment Runtime.
  - Equipped for Low-Voltage Disconnect.

The following equipment is included in the 18 GHz spur microwave link:

- 2 Digital Microwave 18 GHz Radios.
- Spur Radios Equipped for Hot Standby Operation.
- 4 Gigabit Ethernet Interfaces per Radio.
- Configured for Orderwire Operation (Handset Included).
- 7-foot, 19-inch Equipment Rack.
- 2 1-foot Dish Antennas.
- Flexible Waveguide.
- Waveguide Accessories:
  - Connection Adapters.
  - Hanger Kits.
  - Grounding Kits.
  - Entry Boots.
  - Dehydrators.
- -48 VDC Rectifier Plant (Independent of RF Infrastructure):
  - 7-foot, 19-inch rack.
- Battery Plant:
  - Sized for 24-hour Equipment Runtime.
  - Equipped for Low-Voltage Disconnect.

The proposed Sumter County microwave system is designed to meet the end-to-end channel requirements today and well into the future. Motorola is an experienced integrator of MNI microwave and offers a detailed system design including radios, antenna systems, dehydrator and waveguide and DC charger system. Motorola is providing a full-turnkey solution including installation, path surveys, program management, training (see course syllabus in Section 9 Training in the proposal), FCC Frequency Coordination and Licensing, and equipment warranty. The proposed microwave system is cost effective, meets or exceeds 99.99975% system reliability, includes fault monitoring via MOSCAD NFM, and is easily expandable to meet the future needs of Sumter County.

4.2.7 Interference

Motorola understands the County's desire to keep the existing VHF and UHF base radios and repeaters operational during and after the proposed P25 800 MHz project is complete. This section is provided to inform Sumter County and its agencies of the risk of interference on its VHF and UHF channels due to Intermodulation and to alleviate any concerns regarding interference on the proposed 800 MHz system. Intermodulation can occur in one of several places such as, the transmitter amplifier,

the receiver front end, the multicoupler distribution amplifier, or the antenna system components including the antenna, combiner, cables, or connectors. Motorola's system design has considered this interference impact on the proposed P25 system and has mitigated against both passive and active Intermodulation by utilizing connectors, lines, filters, and low-noise amplifiers, which drastically reduce interference on the P25 system. Additionally, by employing the FRIP, Motorola has verified that our design complies with the interference protection criteria of the Florida Region 9 Plan (Section 7.0 Coverage Methodology in the proposal).

4.2.7.1 Intermodulation

Intermodulation can be broken down into two major categories, active and passive. Active intermodulation is where the mixing is occurring in an active stage such as a transmitter's final amplifier or receiver front end. In these situations, the mixing efficiency is high producing higher-level products. Passive intermodulation occurs in non-active locations such as antennas and combiners or in external locations such antenna mounting structures or towers.

Whenever, frequencies from multiple bands (lo-band, VHF, UHF, 800 MHz) are co-located at a tower site, the risk of Intermodulation increases. Intermodulation occurs when two or more signals mix. The results of the mixing will be the various sum and difference products as well as the original frequencies. Any number of frequencies can mix in various combinations. If two frequencies, A and B, are mixed together (a "second order" product), the following products can result: A+B, A-B, 2A+B, 2A-B, 2B+A, 2B-A, 3A+B, 3A-B, 3B+A, 3B-A, 3B+2A, 3B-2A and so on. If three frequencies A, B & C are mixed (a "third order" product), the following products can result: A+B+C, A+B-C, A+C-B, B+C-A and so on.

Intermodulation products are generally grouped by their order. The order is simply the sum of the coefficients of the frequencies that make up a particular mix. For example, A+B represents intermodulation. In this case, the coefficients of both A and B are 1 and 1 + 1 equals 2. The example A+B-C is a "third order" product. The coefficients of A, B and C are all one, so 1 + 1 + 1 equals 3, a 3rd order mix. The product 2A-B is also a "third order" mix. The coefficient of A is 2 and the coefficient of B is 1; therefore, 2 plus 1 equals 3, which indicates a 3rd order mix. 3A-2B would be a 5th order mix and 5A-4B would be a 9th order mix.

4.2.7.1.1 Impact to Sumter County

Motorola has conducted multiple Intermodulation studies to provide an accurate expectation of the impact on the new P25 800 MHz system and the equipment in use today which will be collocated at the proposed P25 sites. Motorola's studies confirmed that using any of the 9 800 MHz frequencies allocated to Sumter County with any of the licensed frequencies called out in the RFP would result in no direct, 3rd or 5th order intermodulation hits.

4.2.7.1.2 P25 800 MHz Only Simulcast Sites

The Simulcast system proposed utilizes some sites which do not currently have any of the County frequencies listed in the RFP. These sites are Linden, Rutland, and Wilsons Corner. The 800 MHz band was developed with 45 MHz spacing between transmit and receive. This spacing drastically reduced interference caused by other frequencies in the 800 and 900 MHz band. Motorola's report confirmed that using any of the 9 800 MHz frequencies allocated to Sumter County would result in no direct, 3rd or 5th order intermodulation hits, as seen in Table 4-10.

Table 4-10: Intermodulation Hit Results – P25 800 MHz Only Simulcast Sites

Transmit Freq	Receive Freq	Total Hits	Direct Hits	3rd Order
851.0375	806.0375	0	0	0
851.4000	806.4000	0	0	0
851.5375	806.5375	0	0	0
851.8375	806.8375	0	0	0
852.0875	807.0875	0	0	0
852.9000	807.9000	0	0	0
853.2000	808.2000	0	0	0
853.5125	808.5125	0	0	0
853.5875	808.5875	0	0	0

4.2.7.1.3 Bushnell VHF, UHF, and 800 MHz 8TAC and 800 MHz P25 Simulcast Site

This site is co-located with or nearby 5 VHF transmitter frequencies and 12 VHF talk-back mobile use frequencies. In the event that the perfect combination of frequencies are transmitting at the site, there are several direct hits and a few 3rd order hits as shown in Table 4-11.

Table 4-11: Intermodulation Hit Results – Bushnell VHF

Transmit Freq	Receive Freq	FCC License	Total Hits	Direct Hits	3rd Order
153.9650	150.805	KIB405	83	2	0
154.8150	151.07	WQIX339	74	4	1
155.3850	154.815	WPMN334/WQIX339	222	11	2
156.1350	155.415	KIB405	257	40	4
159.0150	155.55	WPMN334/WQIX339	289	0	5
	155.985	KIB405	96	21	5
	156.045	WPMN334	84	32	4
	156.21	WQIX339	0	0	5
	158.79	WQIX339	0	0	0

Transmit Freq	Receive Freq	FCC License	Total Hits	Direct Hits	3rd Order
	159.075	KIB405	160	0	2
	159.09	WQIX339	139	37	2
	159.195	KIB405	147	6	2

Also located nearby are 3 UHF transmitter frequencies and 6 UHF talk-back mobile use frequencies. In the event that the perfect combination of frequencies is transmitting, there are several direct hits and a few 3rd order hits as shown in Table 4-12.

Table 4-12: Intermodulation Hit Results – Bushnell UHF

Transmit Freq	Receive Freq	FCC License	Total Hits	Direct Hits	3rd Order
453.3000	453.3	WQEQ686	96	21	1
453.7500	458.3	KIB405	84	32	1
460.1000	458.75	KIB405	70	19	1
	460.4375	WQIX339	76	11	1
	465.1	KIB405	44	3	0
	465.4375	WQIX339	39	0	0

Motorola has proposed to locate the 5 Mutual Aid 8TAC channels at this site as well. Motorola's report confirmed that using neither the 5 8TAC frequencies nor the 9 800 MHz frequencies allocated to Sumter County would be impacted by intermodulation hits, as seen in the table below.

Table 4-13: Intermodulation Hit Results – Bushnell 800 MHz ITAC and 800 MHz P25 Simulcast

Transmit Freq	Receive Freq	FCC License	Total Hits	Direct Hits	3rd Order
851.0125	806.0125	8TAC	0	0	0
851.5125	806.5125	8TAC	0	0	0
852.0125	807.0125	8TAC	0	0	0
852.5125	807.5125	8TAC	0	0	0
853.0125	808.0125	8TAC	0	0	0
851.0375	806.0375	P25	0	0	0
851.4000	806.4000	P25	0	0	0
851.5375	806.5375	P25	0	0	0
851.8375	806.8375	P25	0	0	0
852.0875	807.0875	P25	0	0	0
852.9000	807.9000	P25	0	0	0
853.2000	808.2000	P25	0	0	0
853.5125	808.5125	P25	0	0	0
853.5875	808.5875	P25	0	0	0

4.2.7.1.4 Sumterville Low-band, VHF, UHF, and 800 MHz P25 Simulcast Site

Motorola's report confirmed that using any of the 9 800 MHz frequencies allocated to Sumter County would result in no direct, 3rd or 5th order intermodulation hits at the Sumterville site.

This site is co-located with or nearby 2 VHF Low-band frequencies used for transmitter and talk-back mobile operation. In the event that the perfect combination of frequencies are transmitting at the site, there are several direct hits and a few 3rd order hits as shown in Table 4-14.

Table 4-14: Intermodulation Hit Results – Sumterville VHF Low-band

Transmit Freq	Receive Freq	FCC License	Total Hits	Direct Hits	3rd Order
45.8600	45.8600	KIB405	277	9	8
45.9400	45.9400	KIB405	273	7	8

This site is co-located or nearby 8 VHF transmitter frequencies and 12 VHF talk-back mobile use frequencies. In the event that the perfect combination of frequencies are transmitting at the site, there are several direct hits and a few 3rd order hits as shown in Table 4-15.

Table 4-15: Intermodulation Hit Results – Sumterville VHF

Transmit Freq	Receive Freq	FCC License	Total Hits	Direct Hits	3rd Order
153.9650	150.805	KIB405	761	71	6
154.8150	151.07	WQIX339	704	77	3
154.9500	154.815	KIB405/WQIX339	1004	118	9
155.0400	155.415	WPMN334	972	131	12
155.3700	155.55	KIB405/WQIX339	985	55	6
156.1350	155.985	KIB405	952	166	9
156.2100	156.045	WQIX339	1020	69	21
159.0150	156.21	KIB405/WQIX339	818	91	10
	158.79	WQIX339	625	135	6
	159.075	KIB405	755	46	17
	159.09	WQIX339	624	162	12
	159.195	KIB405	633	49	8

Also located nearby are 15 UHF transmitter frequencies and 27 UHF talk-back mobile use frequencies. In the event that the perfect combination of frequencies are transmitting at the site, there are several direct hits and a few 3rd order hits as shown in Table 4-16.

Table 4-16: Intermodulation Hit Results – Sumterville UHF

Transmit Freq	Receive Freq	FCC License	Total Hits	Direct Hits	3rd Order
453.2750	453.275	KNDC770	470	72	1
453.7500	453.925	KIB405	531	117	2
453.9250	458.275	WPCY388	604	121	3
458.2750	458.75	KNDC770	763	213	7
458.9250	458.925	WPCY388	679	111	7
460.1000	460.4375	KIB405	801	90	6
460.4375	462.95	WQIX339	1094	331	23
463.0000	462.975	WNGP373	1041	332	30
463.0250	463.025	WNGP373	1001	276	24
463.0500	463.05	WNGP373	1014	272	24
463.0750	463.075	WNGP373	994	261	27
463.1000	463.1	WNGP373	975	263	27
463.1250	463.125	WNGP373	989	267	25
463.1500	463.15	WNGP373	981	272	24
463.1750	463.175	WNGP373	982	268	22
	465.1	KIB405	796	158	5
	465.4375	WQIX339	726	131	4
	467.95	WNGP373	465	168	3
	467.975	WNGP373	459	164	3
	468	WNGP373	456	163	4
	468.025	WNGP373	449	165	5
	468.05	WNGP373	447	158	4
	468.075	WNGP373	453	162	4
	468.1	WNGP373	452	167	3
	468.125	WNGP373	445	163	3
	468.15	WNGP373	446	158	3
	468.175	WNGP373	429	141	4

4.2.7.1.5 The Villages VHF, UHF, and Two 800 MHz P25 Sites

This site is co-located with or nearby 1 VHF transmitter frequency and 2 VHF talk-back mobile use frequencies. Motorola's report shows that the VHF frequencies allocated to The Villages could be impacted by a combination of the frequencies in-use and proposed; however, there were no direct or 3rd order intermodulation hits. The Total Hits shown in Table 4-17 were all 5th order combinations.

Table 4-17: Intermodulation Hit Results – The Villages VHF

Transmit Freq	Receive Freq	FCC License	Total Hits	Direct Hits	3rd Order
153.9275	153.9275	WQAL414	169	0	0
	156.2175	WQAL414	156	0	0

Also located nearby are 5 UHF transmitter frequencies and 5 UHF talk-back mobile use frequencies. In the event that the perfect combination of frequencies is transmitting, there are several direct hits and a few 3rd order hits as shown in Table 4-18.

Table 4-18: Intermodulation Hit Results – The Villages UHF

Transmit Freq	Receive Freq	FCC License	Total Hits	Direct Hits	3rd Order
453.1875	458.1875	WQCN441	506	171	5
453.5375	458.5375	WQCN441	520	163	5
460.0375	465.0375	WQCN441	45	17	0
460.1875	465.1875	WQCN441	38	10	0
460.4125	465.4125	WQCN441	156	0	0

Also located nearby are 9 800 MHz P25 transmitter frequencies and 9 800 MHz talk-back mobile use frequencies. Motorola's report confirmed that adding the 9 800 MHz frequencies allocated to Sumter County, to The Villages site would not impact the existing The Villages 800 MHz system, as seen in Table 4-19.

Table 4-19: Intermodulation Hit Results – The Villages 800 MHz P25

Transmit Freq	Receive Freq	FCC License	Total Hits	Direct Hits	3rd Order
851.1500	806.1500	WQMN785	0	0	0
851.3750	806.3750	WQMN785	0	0	0
851.6750	806.6750	WQMN785	0	0	0
851.9000	806.9000	WQMN785	0	0	0
852.1500	807.1500	WQMN785	0	0	0
852.6500	807.6500	WQMN785	0	0	0
853.1375	808.1375	WQMN785	0	0	0
853.3000	808.3000	WQMN785	0	0	0
853.6250	808.6250	WQMN785	0	0	0
853.8625	808.8625	WQMN785	0	0	0

The detailed Intermodulation reports are included in Appendix C Intermodulation and FRIP Reports in the proposal.

4.2.7.2 Florida Region 9 Interference Protection Standards

Motorola's P25 design complies with the region 9 plan standards for protection against interference to and from incumbent and potential licensees. Final FRIP reports for all the proposed channels at all sites are included in Appendix C Intermodulation and FRIP Reports in the proposal. These reports include all required data, calculations, listings, and analyses that show no interference impact and demonstrate compliance with the Region 9 Plan.

4.2.8 In-Building Coverage Design

The following section is included in order to explain the testing and engineering testing conducted during site walks.

Sumter County Critical Building Requiring Coverage

In accordance with the Sumter County RFP, Motorola has evaluated the identified critical buildings addressed in Attachment C that need to have 95% reliable coverage. Motorola and Mann Wireless used a Berkeley Varitronics (Mongoose) spectrum analyzer to test signal levels. We used -105 dB signal level as the threshold for a no talk in/out or talk in/out with artifacts level to determine if a BDA was needed. In all buildings that Motorola and Mann Wireless was able to get access, levels were read at varying points to determine Bi-Directional Amplifier needs. Table 4-20 is the actual measurement readings captured for those buildings to which we had access.

Table 4-20: Critical Building Coverage Measurements

Location	Readings
The Villages Hospital	Stair 3: -100/-107 Stair 5: -97/-102 Kitchen: -107/-108; -88; -96 Loading Dock -85; -90 Operating Room: -104 no access deeper in Emergency Room: -112,-102, -111, -105, -95 by door -94 -95 to -100 -96 -92 BDA solution needed 1st level ER & OR
VPS Station 40: BDA	BDA
VPS Station 41	-72 -77 -20

Location	Readings
	-67 No BDA
VPS Station 42	-101 to -105 -95 -90 outside No BDA
VPS Station 44	-79 -61, -68 -96 EOC -87 -76 -79 -84 -72 -75 -73 -71 -52 NO BDA
VPS Station 51	-61, -67, -58 -61 -78 -67/-64 No BDA
Sumter County Service Center	Library: -81 Back Hall: -84 -74 -67 -70 -82 -80 -70 No BDA
SCFR Station 31 (Fire Station)	Office: -95 to -101 -99 -112 -103 -104 Bay: -95 -92 BDA Solution
Wildwood PD	-107 to -110 -97 bda -106, -107 -102 -95 BDA Solution

Location	Readings
SCFR Station 33	-96; -97 -96, -99, -93 No BDA
Sumter County Courthouse	BDA only 1w80 Nextel in Place
Sumter County Public Works	No BDA
Sumter County Sheriff's Office	BDA only 1W80 Nextel in Place
The Villages Annex (So)	70; 82; 78 -95 -76 -81 -88 -83 No BDA
VPS Station 43	-106 -99 -99 -102 -111 BDA Solution

Bi-Directional Amplifiers Provided

The remaining buildings addressed in RFP Attachment C were evaluated based on site footprint and predicted coverage reliability. For those buildings not addressed in the signal level testing, Motorola provided a bi-directional amplifier solution, if the building requires one. Table 4-21 shows the complete building list and explains if the building was tested and whether or not a BDA was included or needed.

Table 4-21: Building list

Building	Site Walked and Tested	BDA Included
The Villages Hospital	Yes	Yes
Sumter County Courthouse	Yes	Yes
Sumter County Service Center	Yes	No
Sumter County Public Works	Yes	No
Sumter County Animal Control	No	No
Sumter County Waste Management	No	Yes
SCFR Station 11	No	Yes
SCFR Station 12/Webster PD	No	Yes
SCFR Station 14	No	Yes
SCFR Station 22	No	Yes
SCFR Station 21	No	Yes

Building	Site Walked and Tested	BDA Included
SCFR Station 28	No	Yes
SCFR Station 29	No	Yes
SCFR Station 31	Yes	Yes
SCFR Station 32	No	No
SCFR Station 33	Yes	No
SCFR Station 34	No	Yes
Sumter County Sheriff's Office	Yes	Yes
Lake Panasoffkee Annex (SO)	No	Yes
The Villages Annex (SO)	Yes	No
Wildwood Annex (SO)	No	Yes
Wildwood PD	Yes	Yes
Bushnell PD	No	Yes
Center Hill PD	No	Yes
Coleman PD	No	Yes
VPS Station 40	Yes	Yes
VPS Station 41	Yes	No
VPS Station 42	Yes	No
VPS Station 43	Yes	Yes
VPS Station 44	Yes	No
VPS Station 51	Yes	No

Please refer to the Infrastructure/Subscriber Pricing Response for the specific building costs.

4.3 ASTRO 25 IP System Components and Features

An ASTRO 25 system is a feature-rich, modular platform that consists of a Master site, ASTRO 25 RF site(s), and ASTRO 25 simulcast sell(s). This section discusses the various key features and equipment components that make up the proposed system.

Master Site

The Master site is the central point for all system traffic in each ASTRO 25 zone. Call processing and system management occur at the Master site.

RF Sites

ASTRO 25 RF sites provide communications for radio users into and out of the ASTRO 25 network. All ASTRO 25 voice sites are inherently configured to support integrated 9.6 kbps data (IV&D). RF Sites include ASTRO 25 repeater sites, simulcast cells, and conventional channel sites.

Simulcast Sites

The ASTRO 25 simulcast infrastructure consists of a central simulcast Prime site (a typical prime site shown in Figure 4-5) and up to 15 distributed simulcast remote sites, each with up to 30 channels (a typical remote site shown in Figure 4-6). The Prime site acts as a control and digitized audio center for the simulcast subsystem. Audio is routed to the prime site from each simulcast remote site. To ensure that the best audio from the simulcast receivers is processed, a voting comparator selects the best signal.

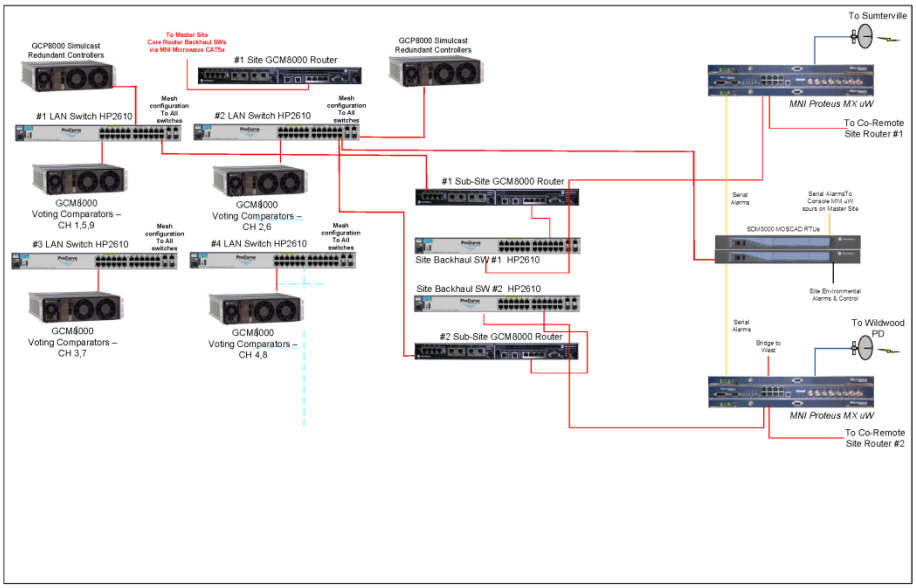


Figure 4-5: Basic diagram of a typical ASTRO 25 simulcast Prime site

The Prime site contains redundant Prime site simulcast controllers, simulcast comparators, and networking equipment to interface to the remote simulcast sites. The simulcast RF transmitters and receivers are located at the simulcast Remote sites. These sites simultaneously transmit identical information from each site to the radios. The receivers at these sites receive the audio from the user radios, and pass the audio back to the Prime site for voting. Audio and site control comes from the Prime and Master sites. Equipment at a simulcast Remote site includes a simulcast base radios, fault management equipment, and networking equipment to interface to the Prime site.

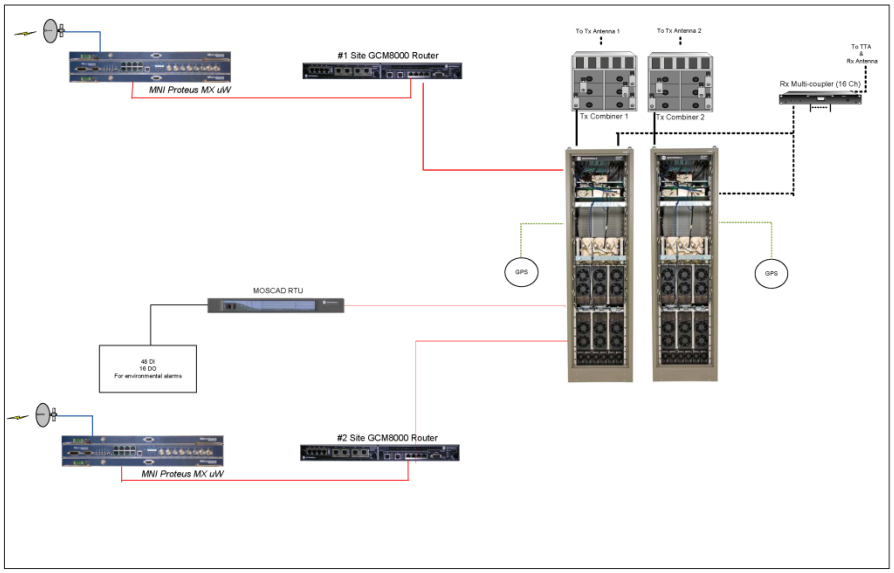


Figure 4-6: Basic diagram of a typical ASTRO 25 simulcast Remote site

4.3.1 Master Site Components

Master site equipment is described briefly in the following sections.

4.3.1.1 Zone Controller

The Zone Controller is a redundant processor that provides trunking call processing for ASTRO 25 system operation. The Zone Controller forms the heart of a wide area radio system by providing the central processor for the zone with the necessary hardware and software capabilities to provide call processing and mobility management.

The Zone Controller builds upon the strength and experience of Motorola wide area trunking systems to deliver multiple layers of reliability for business critical, mission critical and life critical applications.

The Zone Controller is supplied in a redundant controller configuration, and provides the following:

- ***System Availability –*** The Zone Controller allows software upgrades once loaded, providing enhanced system availability.
- ***Intelligent Switchover –*** The Redundant Configuration provides automatic switchover to the standby controller if a loss of wide area communications is detected. Notification can be sent to the user if other components fail, allowing the user to manually switch to the standby controller if desired.
- ***Cross Controller Compatibility –*** Capable of running two different versions of software simultaneously, ensuring that upgrades are fully functional with one controller before upgrading the second controller.
- ***Redundant Configuration –*** The Redundant Zone Controller is a computer platform with redundant-processors that provide trunking call processing for ASTRO 25 wide area radio communication systems. The Redundant Zone Controller is designed to detect failures by automatically switching operation to the standby controller, minimizing interruption of call processing functionality.

4.3.1.2 Integrated Voice and Data

The Project 25 compliant IV&D operation allows data traffic to seamlessly utilize your existing ASTRO 25 stations, improving in-field efficiency. Voice is prioritized, allowing mission critical traffic to always take precedence over data transmissions. The IV&D service creates a data transport layer capable of supporting both industry standard IP and customer-developed applications, including:

- Text Messaging.
- GPS Location.
- Over the Air Programming (POP25).
- Over the Air Rekeying (OTAR).
- NCIC Queries.
- Automatic License Plate Recognition.

Users can achieve a number of important benefits, including:

- Conservation of valuable airtime.
- Increased communications accuracy.
- Allows users in field to perform queries without dispatch.
- Better return on investment – same assets for multiple functions.
- Utilizes common radio units for both voice and data applications.

Over-the-Air Programming

Motorola's over-the-air programming feature is called Programming Over P25 (POP25). POP25 allows radios to be remotely configured from your network by sending a sequence of commands over-the-air via the IV&D transport layer. POP25 enables reconfiguration of radio user functionality without physically touching the radio.

POP25 allows end users and radio users to stay in the field during the reconfiguration process, thus saving valuable time and resources.

POP25 can reduce the total amount of time spent per radio unit update by up to 85%, allowing users and equipment to remain operational in the field. Assuming one reprogramming event every other year over the average lifetime of a radio (10 years), the total coordination and programming time can be reduced from 3.5 hours to only 30 minutes.

Other substantial benefits include:

- No loss of communications while reprogramming occurs.
- Programming resumes automatically after interruption.
- Quicker network optimization.
- Eliminates time spent tracking assets for reprogramming.

Text Messaging Service

Similar to text messaging on a cell phone, the Text Messaging Service provides a convenient means of communication between all network users. A user can send a text message of up to 200 characters to another radio or dispatcher. Dispatchers and radio users may be a part of a named text-messaging group, allowing point-multipoint service. Text Messaging Service makes use of the IV&D transport layer, and provides a store and forward function, ensuring message delivery.

4.3.1.2.1 Packet Data Gateway

The Packet Data Gateway (PDG) is a modular platform designed to link the wireline IP Data Network to Motorola‘s ASTRO 25 Trunked radio frequency (RF) network.

The PDG software platform manages IP message traffic to and from the wireless network supporting wide area roaming. With wide area roaming, data radios can roam seamlessly throughout the coverage area of the ASTRO 25 trunked system without the need to select a different channel or have any specific knowledge of the RF network.

The PDG supports SNMP-based network management by providing detailed statistics and alarm information to monitor system activity and performance. These statistics and alarms allow you to monitor system operation and loading to support audit, diagnostic, and optimization activities using SNMP-based standard. The information can be viewed directly via the PDG local console or through the Network Management System.

4.3.1.2.2 Motorola GPRS (General Packet Radio Service) Gateway Service Node (GGSN) Router

The Motorola GGSN router provides for the internetworking between the Customer's network and the ASTRO 25 data system allowing for independent management of IP addresses across networks.

The Motorola GGSN router handles the IP routing services in support of End-to-End IP data messaging. These services include Static and Dynamic IP addressing, IP fragmentation, and ICMP error reporting messaging for diagnostics and troubleshooting.

4.3.1.3 ISSI Interface

Each ISSI.1 Network Gateway Application allows 27 simultaneous trunked calls between systems and 60 interoperability talkgroup pairs. The network gateway architecture has some distinctive advantages, which are outlined below. A single ISSI.1 Network Gateway Application has been included in the Sumter County's proposal. The ISSI Network Gateway can be immediately deployed to other ISSI Home or Visitor networks. However, the connection requires that an ISSI Ethernet connection be made and that the other participating ISSI have an open port on their system. This proposal includes an ISSI for Sumter County as described in the RFP.

For example, Lake County, which is east of Sumter County, currently has ISSI in their Motorola ASTRO 25 system. If Sumter and Lake County wanted to connect, an Ethernet link would have to be established from the Sumter County system to the Lake County system. This approach would be the same for any neighboring County that has ISSI connectivity, such as Marion County and the City of Ocala, both of which are Motorola ASTRO 25 systems with capability of adding ISSI interfaces.

A high-level, generic use case of how two systems are connected is shown in Figure 4-7.

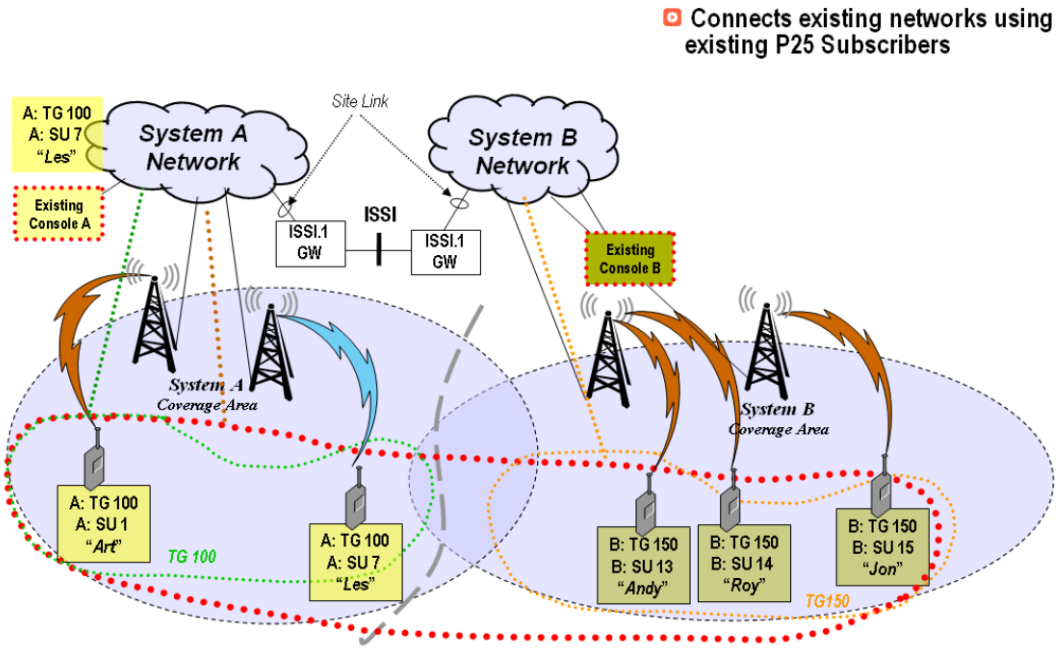


Figure 4-7: ISSI.1 Network gateway solution

The ISSI.1 network gateway application enables the connectivity across the two (or more) systems by "mapping" talkgroup IDs from one System A to another System B. In the example talkgroup100 on System A is associated in the gateway to be connected to talkgroup 150 on System B. Should any of the users ("Art", "Les", "Andy", "Roy", or "Jon") key up in either network, the Zone Controllers send the call to the site gateways which then send the audio and signaling to the other network and initiate the associated talkgroup traffic, thereby creating a "virtual" inter-system talkgroup operation.

In the roaming case shown in Figure 4-8, the roaming user, "Les", "manually roams" into the other system. Once "Les" notices that the signal from his current system (System A) begins to decline, he would initiate a mode change on his radio, either by changing the knob or through the keypad. This process is also known as "fingertip roaming". He also would need to know the "associated" talkgroup 150 on System B.

Once he has selected talkgroup 150 on System B, "Les" would be operating on the virtual talkgroup spanning the two systems. Readers familiar with P25 roaming will recognize this operation to be identical to system-to-system roaming used today. The important enhancement for "Les" is that after he roams into System B, he will continue communications with his home dispatcher in System A as well as any users who are still on talkgroup 100 in System ("Art").

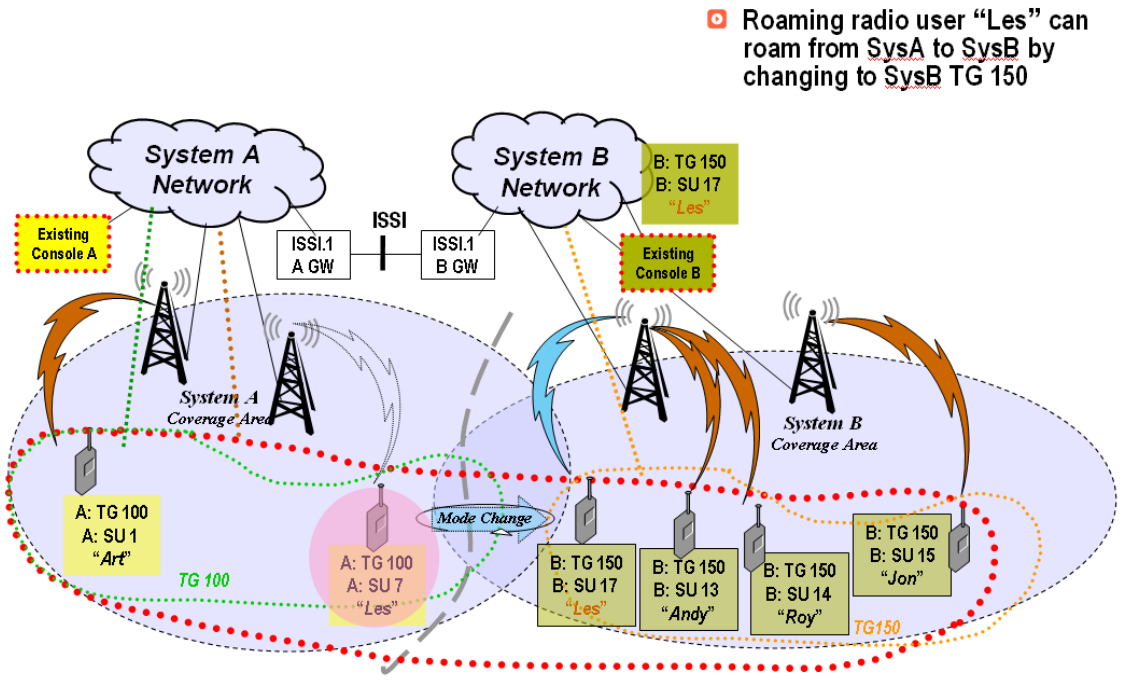


Figure 4-8: ISSI.1 network gateway solution – roaming

Advantages of the ISSI.1 Network Gateway Application Architecture:

- Connects systems with different system IDs – The ISSI.1 Network Gateway Application enables two systems, each using a different system and WACN ID to be connected over a wireline connection.
- Can be added to existing ASTRO 25 Networks ('bolt-on') – The ISSI.1 Network Gateway Application can be added to an existing and deployed ASTRO 25 network without requiring that the network be upgraded to a new version.
  - The gateway enables two systems to be connected together of virtually any Motorola vintage (ASTRO 25 6.9 or higher), effectively decoupling systems and avoiding inter-agency funding dependences.
  - An ancillary benefit of the 'bolt-on' implementation is ease of installation. Because the gateway connected at the site link layer, the ISSI.1 Network Gateway application(s) can be installed and configured in the network in a few days, rather than weeks for a zone link.
- Roaming enabled without upgrading subscribers – The ISSI.1 Network Gateway Application enables wireline connectivity using the P25 ISSI without requiring software upgrade to the subscriber devices to enable roaming.
- Networks connect while retaining control of their individual systems' UCS – The ISSI.1 Network Gateway Application preserves the User Configuration Subsystem databases on each side of the gateway enabling users to retain operational autonomy over their system.

- Cost effective implementation – The ISSI.1 Network Gateway is a very cost effective implementation of system interoperability as a result of its site link layer architecture, installation ease, and limited feature set.
- Wireline-based solution enables end-to-end encryption/Does not require Transcoding – The wireline connectivity enables end-to-end encryption, lower audio delay and does not require transcoding or double-vocoding. This advantage is experienced in lower delays, better audio quality and more robust call services than can be accomplished by analog audio-based connections.

Operational Capacities of the ISSI.1 Gateway Application Architecture

- Features Supported – The ISSI.1 Network Gateway Application supports the following features: ISSI Group Call, ISSI Emergency Call, End-to-End Encryption, and ISSI Manual ("finger tip") Roaming are supported.
- Capacity – Each ISSI.1 Network Gateway Application allows 27 simultaneous trunked calls between systems and 60 interoperability talkgroup pairs.
- Console Priority – The ISSI.1 Network Gateway Application does not support Console Priority across the interface.

4.3.1.3.1 ISSI 8000

Motorola has demonstrated its leadership in the P25 ISSI community by being the first manufacturer to announce a shipping product that supports the P25 ISSI. Motorola has also participated in multi-vendor ISSI demonstrations at IWCE (2007) and APCO (2008 and 2009), and hosted the first P25 ISSI Interoperability Event in February 2010.

The ISSI.1 Network Gateway is Motorola's first P25 ISSI solution and has been shipping since December 2009.

Motorola's Next Generation Interoperability solution is the ISSI 8000. This will be software applications that reside on a server. As part of Motorola's commitment to Sumter County, both in support and in migration, if Sumter chooses to purchase the ISSI 8000, it will be available in late 2012 as part of the 7.13 release.

The ISSI 8000 solution is an Interoperability Solution that enables an ASTRO 25 system release 7.13 or higher to connect to other P25 systems regardless of their RF bands, manufacturer type and release versions. ISSI 8000 is built to the TIA-102 suite of standards used for the design of Project 25 interoperable communication products. The ISSI 8000 provides customers more interoperability choices and allows them more features (automatic seamless roaming, PTT ID, P25 TDMA support) than the existing ISSI.1 solution.

The ISSI 8000 is currently in the early product planning stages and currently being targeted for availability in Q4 2012. The ISSI 8000 is optional to the ASTRO 25 core.

Table 4-22 lists features that define what P25 ISSI trunking features Motorola supports in their ISSI.1 and ISSI 8000 product offerings.

Table 4-22: P25 ISSI trunking features

v.10.0	P25 ISSI Trunking Features Offered by Motorola			
	P25 ISSI Trunking Feature Name	Offered by Motorola ISSI.1 ?	Offered by Motorola ISSI 8000?	TIA-102 Standards Document
Voice & Mobility Features				
	Voice Features			
	Broadcast Call	No	Yes	TIA-102.BACA-A
	Announcement Group Call	No	Yes	TIA-102.BACA-A
	Confirmed Group Voice Service	No	Yes	TIA-102.BACA-A
	Unconfirmed Group Voice Service	Yes	Yes Note 1	TIA-102.BACA-A
	Emergency Group Call	Yes	Yes	TIA-102.BACA-A
	Encrypted Voice (AES)	Yes	Yes	TIA-102.BACA-A
	P25 Full-rate vocoder (FDMA)	Yes	Yes	TIA-102.BACA-A
	P25 Half-rate vocoder (TDMA)	No	Yes	Future
	SU and Group Mobility Management			
	SU Registration	No	Yes	TIA-102.BACA-A
	Transport of Authentication Credential	No	Yes	TIA-102.BACA-A
	Secure SU registration (SU authentication)	No	Yes	TIA-102.BACA-A
	SU Deregistration	No	Yes	TIA-102.BACA-A
	Group Affiliation	Yes	Yes	TIA-102.BACA-A
	Call Restriction	No	Yes	TIA-102.BACA-A
	Roaming			
	Inter-WACN (manual)	Yes	Yes	TIA-102.BACA-A
	Inter-WACN (automatic)	No	Yes	TIA-102.BACA-A
	Inter-System (manual)	Yes	Yes	TIA-102.BACA-A
	Inter-System (automatic)	No	Yes	TIA-102.BACA-A
	Intra-System (automatic)	No	Yes	TIA-102.BACA-A
	RFSS Service Capability Polling	Yes	Yes	TIA-102.BACA-A-2
Supplementary Services Features				
	Transport of Talking Party Identity	No	Yes	TIA-102.BACA-A
	Priority Call	No	Yes	TIA-102.BACA-A
	Emergency Alarm	No	Yes	TIA-102.BACD-B
	Emergency Alarm Cancellation	No	Yes	TIA-102.BACD-B
	Group Emergency Cancellation	No	Yes	TIA-102.BACD-B
NOTES Note 1: Motorola's ISSI 8000 support unconfirmed group call only as a serving system				

4.3.1.4 IP Logging Recorder and Playback System

Motorola has included a NICE Inform server and IP Radio Logger at the Sumter County SO – Master Site and three Inform reconstruction licenses, one for each Dispatch Supervisor (Sheriff's SO, Wildwood PD, and Rural Metro).

Overview

The recording of the ASTRO 25 Radio System is performed by the MCC7500 IP Radio Logger. The Logger resides on the Motorola Radio Network and records all Talk Groups and Conventional Radio that are directed to it via the Motorola AIS.

The user application associated with the Logger is Inform Lite. Inform Lite is a .NET application that is delivered to user PC's via a browser. Inform Lite provides users with simple-to-use tools and a friendly Windows-based GUI to perform standard functions such as search/playback and system administration.

The web-server that delivers Inform Lite to the users can reside on either the Motorola Radio Network or the customer network. Whichever network is selected, any PC workstation on that network can be an access point to the system for trusted users. Please note that due to security reasons, if the Inform Lite web-server is located on the radio network it cannot deliver applications to users on the customer network – and vice versa.

Inform Lite does support remote access from off-site users, providing the remote access conforms to the minimum security requirements of that network.

Motorola IP Radio Logger

The Motorola AIS and IP Radio Logger (separate devices) can be configured to support recording for up to 120 simultaneous conversations.

The solution can have up to 256 Talkgroups assigned to it (assigned for recording) without impacting the price of the system.

The logger will store up to 50,000 hours of talk-time on-line. It also offers DAT tape drives for removable archiving.

The IP Radio Logger has several resiliency features:

- Redundant Power Supplies.
- Dual Removable Archive Devices (for audio files).
- RAID 5 for the internal HDD (if a drive fails, the system keeps working).
- Tape backup for the SQL Database.

The Motorola IP Radio Logging solution is the only solution certified by Motorola for ASTRO 25 systems.

As mentioned above, the IP Radio Logger also records all call data associated with each PTT in the digital trunked system. This data includes (but is not limited to) the following information:

- Talk Group ID.
- User ID.
- Alias.
- Zone ID.
- Encrypted/Unencrypted.

All of this data goes into an MS SQL Database. Users can find audio records using any of the above information as search criteria. This makes searching much faster and efficient than anything the customer has used before.

The Logger will also capture system events such as ‘busy/wait’, ‘busy/reject’, ‘Emergency Button Activation’, and more. This information can enhance a users understanding of the events under review.

User Application: Inform Lite

Inform Lite is a .NET application that works like a browser. It is delivered to users via a web-server. The web-server can be a PC workstation or a server. Inform Lite can be delivered to any PC workstation on the common network, or via remote access – assuming that the user has the proper security credentials and that access meets the security requirements of the network.

Inform Lite is a scaled-down version of the full Inform application suite. It is designed to meet the price requirements of small and medium sized recording users. Inform Lite can be licensed to access up to 3 recorders and it can view up to 352 'Resources' (a resource is a Talk Group, a conventional radio channel, a telephone position/extension, or a telephone line). Inform Lite can support up to 5 concurrent simultaneous users. Specific licensing is configured to meet four concurrent users as required by the RFP.

At any time, an Inform Lite system can be upgraded to full Inform. This can be done to exceed the licensing limitation of Inform Lite, or it can be done to add additional Next Gen 911 functionality, such as recording CAD screen activity, Mapping screens, video camera recordings, mobile DVR recordings, and more.

Inform Lite has been designed specifically for the Public Safety/First Responder market. It is the culmination of over 20 years of experience in the marketplace and it is deployed at hundreds of PSAP's around the country.

Figure 4-9 is a snapshot of the Windows-based GUI. Any user familiar with Windows will find Inform Lite easy to learn and easy to use.

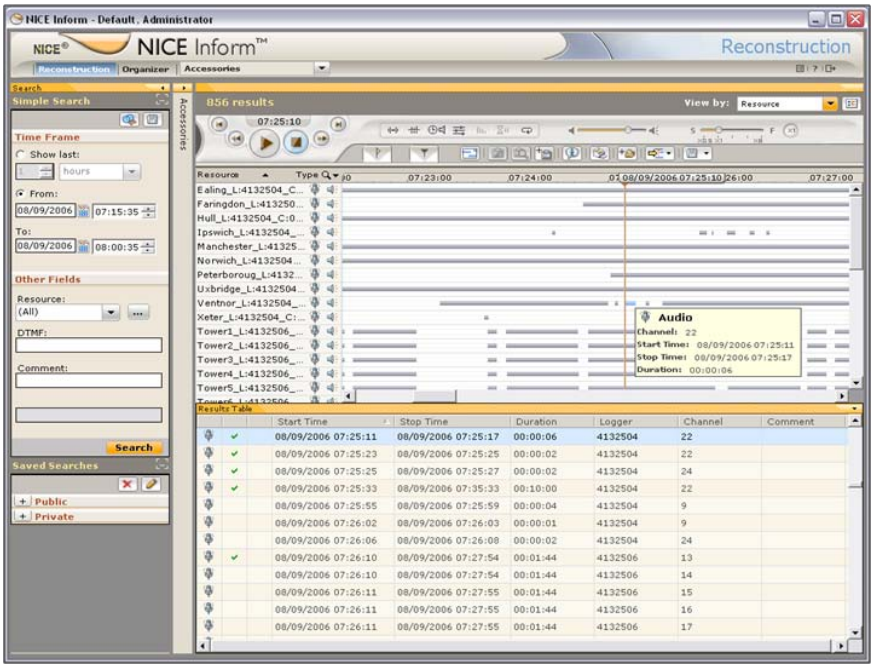


Figure 4-9: NICE Inform Lite application window

Professional Services

The Motorola proposal includes all services necessary for a successful installation. It includes a NICE Project Manager (remote) and a NICE Installation Specialist.

Included in the proposal is User Training. The NICE Installation Specialist will conduct a class of up to 4 participants that covers the Inform Lite application. This is a single day course to be conducted on-site at a central customer facility. The proposal does not incorporate training users separately at each site.

4.3.1.5 Network Transport Subsystem

The ASTRO 25 release transport core is engineered to meet the performance requirements of a real time system transporting voice, call control, network management, and ancillary network services. The Transport Network is a closed network. Only Motorola supplied equipment, applications and services can be used on the network.

Ethernet Switch

The Enterprise Ethernet Switch (LAN Switch) is used to aggregate all the Ethernet interfaces for all servers, clients, and routers. To ensure system availability, redundant LAN switches are provided in the ASTRO 25 system.

Cooperative WAN Routing

The Motorola Cooperative WAN Routing (CWR) solution allows core and exit routers to interface directly with RF sites, network management sites, console sites, and interzone links.

The CWR solution has the following advantages:

- Provides redundant router failover capabilities
- Allows for easy configuration, testing, and maintenance
- Minimizes downtime during upgrades

There are three different types of routers in the CWR:

- ***Core Routers*** - The Core Routers perform the routing control of audio and data in and out of the zone, while achieving the fast access levels required by real-time voice systems. To increase availability, two Core Routers are used.
- ***Gateway Routers*** - Gateway Routers are used for devices that are multicasting beyond their local LAN, such as to IV&D and High Performance Data (HPD) packet data gateways.
- ***Exit Routers*** - Exit Routers are routers that handle Inter-Zone links. To increase availability, redundant Exit Routers are used.

4.3.1.6 Zone Core Synchronization

The Zone Core is synchronized by the Network Time Protocol. The clock source for both types of synchronization is a Stratum 1 source, which is derived from the Global Positioning Satellite (GPS) system. The device used includes redundant GPS receivers and antennas, redundant DC power supplies, and a back-up oscillator. Additionally, a backup oscillator is employed in the unlikely event of lost GPS signal.

4.3.1.7 Information Assurance Elements

Keeping any network secure from unauthorized intrusions is critical. Keeping your Public Safety communications network secure is even more important.

Motorola takes ASTRO 25 network security very seriously. The integration of Information Assurance (IA) is another step towards the continuing enhancement of making sure that these mission critical networks remain operational so that the users can do their jobs better and more efficiently.

The next several paragraphs explain some of the processes, hardware, and software that can be implemented with an ASTRO 25 system. We will work closely with your security team to make sure that this system experiences minimal disruption due to outside sources.

ASTRO 25's IA features, including our network security services, are organized in a hierarchy illustrated in Figure 4-10. Each feature builds upon the previous level. The Information Assurance program is scalable to meet each customer's security requirements.

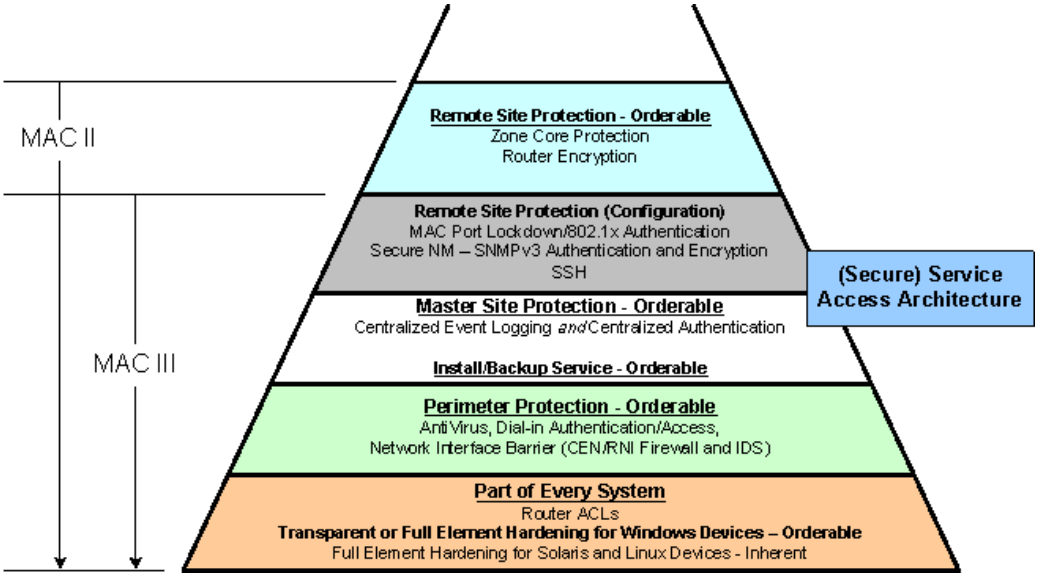


Figure 4-10: Information Assurance

Below are listed several of the key services that are provided in our IA package.

Router ACL (Access Control List)

Router ACLs ensure that only required ports and protocols can pass through the routers, providing an additional layer of protection against unauthorized or malicious traffic.

SSH (Secure Shell)

SSH encrypts the content carried by IP-based network protocols, preventing unauthorized access to information.

Antivirus Service

The Antivirus (AV) Service detects, quarantines, and repairs viruses before they can infect a network. Anti-Virus definitions require regular updates to ensure that the network is continuously protected. All antivirus programs are tested on a similar system prior to implementation to verify that these will not interfere with the networks functionality.

"Dial-In" System Service Interface

This System Service Interface utilizes RSA two-factor authentication to allow remote system access by authorized individuals, allowing them to perform maintenance tasks and monitor system health.

Hardened Passwords

Hardened passwords follow generally accepted strong password guidelines. Implementation of hardened passwords is limited to those protecting default or software service accounts. Passwords protecting user accounts, and that are user accessible, are not included in this feature.

Zone Core Protection

The Zone Core Protection feature protects the System Core site from unauthorized access by providing a combination of Firewalls and Intrusion Detection.

Firewall

The firewall controls the traffic allowed to pass between networks to mitigate any risk to the operational integrity of the ASTRO 25 Radio Network Infrastructure System, and is recommended when the system will be connected to external networks.

Intrusion Detection

The ASTRO 25 system's core or master radio system site is monitored by the Intrusion Detection Sensor (IDS), which analyzes traffic crossing the interface between the radio system master/core site and an external network to detect attempts to compromise the confidentiality, integrity, or availability of a systems resource.

Intrusion Detection and Firewalls complement one another; IDS detects and notifies/logs intrusion events while Firewalls block unauthorized traffic.

Centralized Backup Service (Part of Install/Backup Service)

In conjunction with Element Provisioning, the Centralized Backup Service provides a means to quickly recover a failed or compromised network element. This service provides a repository where volatile data generated and used by the system (configuration files, log data, etc.) is stored. The information stored by the backup service is used to recover system elements to a known state in the event of a failure.

Element Provisioning Service (Part of Install/Backup Service)

The Element Provisioning Service provides a repository for all non-volatile data necessary to provision system elements including operating system, patches, and application software. This repository provides all components necessary to upgrade, restore or replace system elements.

Centralized Event Logging (System Core and Remote Sites)

Centralized Event Logging provides a location to which significant events are forwarded for analysis and storage in the network. This feature provides accountability data and audit records that are an industry recognized element of good system security practices.

Centralized Authentication Service

Centralized Authentication provides the system with a central server, which manages user accounts and implements password policies for the ASTRO 25 system from a single interface. This is intended to prevent unauthorized users from accessing the network.

Port Security (MAC Port Lockdown)

The Port Security feature prevents use of any port by any unauthorized device. Port security is the implementation of MAC Port Lockdown for all layer 2 devices in the radio network.

Secure Network Management SNMPv3

SNMPv3 is the part of current network management protocol standard suite. It provides enhanced security provisions such as:

- Authentication - Validating the source of the message
- Encryption - Protecting the contents of a packet to prevent its contents from being read by an unauthorized source

Router Encryption

Router Encryption equips a system's Core, Exit, and Site routers with encryption modules and provides cryptographic protection for all traffic sent over all site and zone links.

Service Access Architecture (Secure Service Access)

This feature extends the boundary protection provided by the firewall and IDS to the core site to protect the site from potential malicious traffic. It permits a permanent connection between a radio system's core and a geographically separate location for remote system monitoring or maintenance. The feature also reconfigures the "Dial-in" Service Interface to operate through the firewall and IDS.

Network Interface Barrier

The Network Interface Barrier (NIB) is an optional set of hardware and software components providing boundary enforcement and attack detection features to provide enhanced network security protection. Deploying NIBs at each connection point between radio system resources and external networks provides an important and necessary level of security in a mission critical network.

Each Network Interface Barrier is composed of two pieces of equipment: a network interface barrier firewall and an Intrusion Detection Sensor.

- The firewall ensures that only legitimate traffic is allowed to traverse between authorized points in external networks and the radio system.
- The Intrusion Detection Sensor monitors allowed connections and traffic in order to detect anomalies and potential attacks; works with the firewall to block in-progress attacks.

4.3.2 RF Site Components

RF Site equipment is described briefly in the section below.

4.3.2.1 GCP 8000 Site Controller

The GCP 8000 Site Controller (GCP 8000) is the control interface between the transmitter/receiver subsystem and the Zone Controller. The GCP 8000 Site Controller comprises redundant site controller modules; one site controller module acts as the active module, and the second module as standby. The redundancy minimizes the possibility of a single point of failure at the site.

The GCP 8000 provides the following functions:

- Manages the channels to maximize throughput and channel availability.
- Administers registration and context activation requests.
- Monitors base stations and RF distribution equipment and interacts with the MOSCAD site device manager to facilitate centralized alarm and control monitoring.
- Provides redundant site control.
- Enables redundant site link routing for patch redundancy.

Additionally, the GCP 8000 provides the following functions at the simulcast site:

- Provides a time and frequency reference signal to the base stations maximizing frequency stability and allowing for further site separation in a simulcast configuration.
- Provides IP simulcast capability, enabling true end-to-end IP connectivity in a simulcast configuration.

4.3.2.2 GCM 8000 Comparator

The GCM 8000 Comparator ensures the broadcast of the best possible voice signal by combining the best parts of a single signal that has been received by multiple sites in a multisite (simulcast) system.

The comparator features a state-of-the-art digital voting methodology: Frame Diversity Reception. The comparator selects the data frame or signals with the lowest BER and forwards it. By using the best pieces of each input signal, the result is the best possible composite signal.

4.3.2.3 GTR 8000 Expandable Site Subsystem

The GTR 8000 Expandable Site Subsystem (ESS) enclosure can contain reconfigured GTR8000 base stations, site LAN switches, and GCP 8000 controllers, along with an optional Radio Frequency Distribution System (RFDS), depending on your configuration needs.

Voice traffic is routed from each of the site base stations to the system for distribution all sites associated with the call. Benefits of the ESS include:

- Integrated design provides a smaller footprint at the site.
- Front/top access design and minimized cabling reduces install and service labor.
- Increased power supply redundancy through common power bus.

4.3.2.4 Dynamic Dual Mode Functionality at RF Sites

Because Dynamic Dual Mode has been proposed to the Sumter County, each GCP 8000 Site Controller and GTR 8000 Station in the proposed system has been equipped with upgradeability to DDM. This allows each site to adapt for use with both FDMA and TDMA subscribers.

4.3.2.5 Dynamic System Resiliency at RF Sites

Because Motorola has proposed Dynamic System Resiliency for additional reliability to the County, we have configured the GCP 8000 Site Controllers and GTR 8000 Stations in the proposed system to enable DSR at each site.

4.3.2.6 TDMA Upgradeability at RF Sites

Motorola has configured the infrastructure components including GCP 8000 Site Controllers and GTR 8000 Stations in the RF sites in the County's system with upgradeability to TDMA functionality.

TDMA operation provides multiple talk paths using one base station and one frequency. Differences in TDMA and FDMA are illustrated in Figure 4-11 and Figure 4-12.

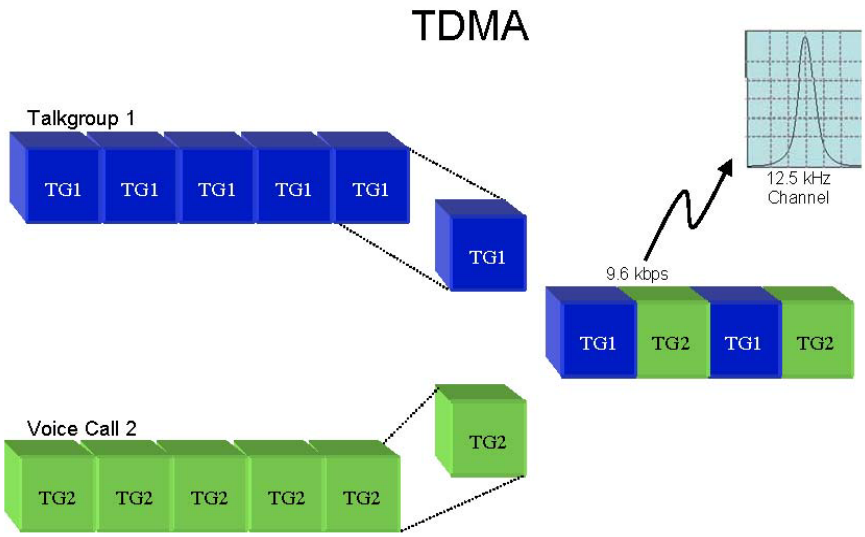


Figure 4-11: TDMA Operation divides a radio frequency into time slots and then allocates slots to calls

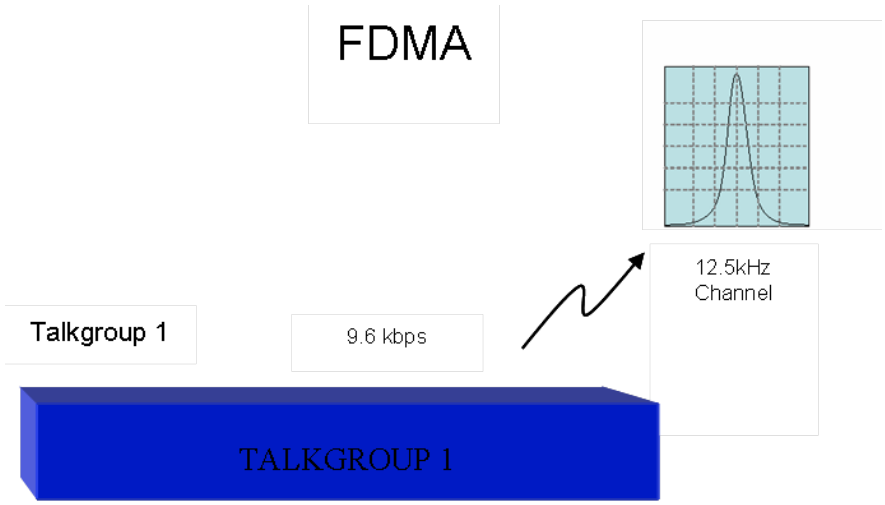


Figure 4-12: FDMA Operation divides spectrum into frequencies, which are then assigned to calls

Some of the critical performance parameters of TDMA include:

- ***Coverage*** – The coverage footprint remains the same as FDMA.
- ***Simulcast Capability*** – The ability to simulcast TDMA, saving on frequencies and improving in-building coverage.
- ***Audio Quality*** – The Delivered Audio Quality (DAQ) will be consistent with FDMA.
- ***FCC Compliance*** – Meets narrow band 6.25 kHz equivalent requirements.

Dynamic Dual Mode (FDMA/TDMA Operation)

Our unique Dynamic Dual Mode network is the next generation, mission-critical technology for the future of Public Safety organizations. With Dynamic Dual Mode, you get more out of your system, increasing capacity with your existing spectrum. Dynamic Dual Mode simultaneously supports P25 FDMA equipment and users, as well as TDMA equipment and users.

The benefits of Dynamic Dual Mode include:

- Permits use of legacy Phase 1 radios and sites.
- Seamless operation to end user.
- Cost savings through reuse of existing equipment.
- Reuse of existing frequency plan.
- Customer definable TDMA migration.
- Maintains interoperability with other Project 25 Phase 1 radios.

4.3.2.7 RF Site Router

The Site Router provides an interface that handles all of the IP Network Management traffic between the Master site and the RF site. The Site Router provides the following:

- ***Media conversion*** – The router converts Ethernet to the selected transport medium.
- ***Traffic prioritization*** – The router applies a prioritization marking to the packets leaving the site.
- ***Fragmentation*** – The router fragments large IP packets per industry standards.

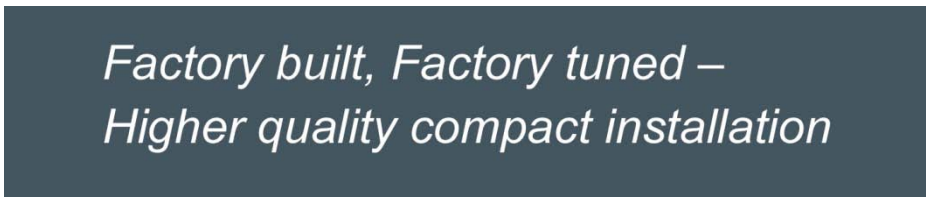
4.3.2.8 Site LAN Switch

The site LAN Switch provides a LAN interface for site equipment and a LAN port for the site router. Through the switch, the service technicians gain access to service the site, and access the system's Graphical User Interface.

4.3.2.9 Radio Frequency Distribution System

The Radio Frequency Distribution System (RFDS) provides interconnect between the base radios and antennas, allowing for a completely contained and more compact installation footprint. For the transmitters this can include isolators, combiners, TX filters, diplexers, and power monitors.

For the receivers this can include duplexers, site preselectors, and multicouplers. Various RFDS options exist for each of the GTR 8000 Base Radio, GTR 8000 Site Subsystem, and GTR 8000 Expandable Site Subsystem.



4.3.2.10 GPW8000 Simulcast Site Reference

The GPW8000 Simulcast Site Reference is a GPS-based frequency and time reference. The GPW frequency reference provides the simulcast system 1 PPS (Pulse per Second), 5 MPPS, and 1 PPS + 5 MPPS composite signals. These signals are used to synchronize the transmission of a simulcast system to improve overall performance and coverage.

This unit provides a high-level redundancy including redundant GPS receivers, backup rubidium standard, and redundant power supplies.

4.3.2.11 Conventional Channel Gateway

The Conventional Channel Gateway (CCGW) is a modified site router. The router supports a 4-wire E & M interface for analog audio. The CCGW allows an analog conventional channel to connect to the transport network in the ASTRO 25 trunking system.

The CCGW is used by the MCC 7500 Dispatch Console to connect the dispatchers to analog conventional channels. Once these channels are connected to the network, dispatchers are able to monitor and transmit on the channel, as well as patch the channels to trunk talkgroups.

4.3.3 System Access Features

To ensure system access, simplify radio operation, and limit operator involvement, the ASTRO 25 platform has many access features, as described below.

Busy Queuing/Call Back

This system has been designed to maximize availability to the end user. In the unlikely event that all the channels are busy, a user depressing their Push-To-Talk (PTT) will be given a busy signal, and placed into a busy queue. When a channel becomes available, the system assigns the users to a channel via pre-assigned priority levels. Once a channel is assigned, the system notifies the user with a call back tone. This feature makes it unnecessary for the radio operator to waste valuable time rekeying their radio in an effort to gain channel access.

Automatic Retry

If a channel request is not received at the Zone Controller, the individual radio unit continues sending channel requests until the Controller acknowledges the request, or until a total of 16 automatic retries occur. This feature eliminates the need for the operator to continually key and de-key their radio, or to keep their radio keyed in an effort to gain system access.

Recent User Priority

To ensure uninterrupted communications, a recent radio user priority provides those users who have been recently assigned a voice channel priority over the other system users. Recent user priority ensures that a talkgroup engaged in a conversation receives priority system access for up to 10 seconds between transmissions.

Misdirected Radio Protection

To ensure that a radio from one talkgroup cannot accidentally be assigned to a voice channel being used by a different talkgroup, the system utilizes embedded signaling. If a unit from a different talkgroup is accidentally assigned the same channel, the radio will recognize that it has been assigned incorrectly, and will automatically revert to the control channel.

Continuous Assignment Updating

Once a talkgroup is assigned a voice channel, the control channel continues to transmit the channel assignment for as long as that talkgroup is using the channel. This ensures that a radio just coming into service will be sent to the appropriate voice channel to join the rest of its talkgroup.

Talk Prohibit Tones

In the event that a user attempts to perform an unauthorized function as defined by system permissions, a talk prohibit tone is given.

4.3.3.1 User Accessibility Features

Enhanced Intermodulation (IM) Reduction

Motorola has developed an enhanced IM reduction feature that helps to improve our radios' performance in the presence of strong near-channel transmissions.

Noise Reduction Software

Our unique Noise Reduction Software (NRS) feature provides improvements in audio quality by minimizing background noise, and maximizing audio quality in high noise environments.

Adaptive Power Control

Adaptive Power Control optimizes the transmit power on the portable radio to extend battery life and minimize interference.

Radio Generalized Gain Control

People talk at different levels depending on their personal usage characteristics or environmental situations. Generalized Gain Control (GGC) is used to reduce audio level variations.

Impres™ Smart Energy System

The Impres Smart Energy System consists of smart batteries and intelligent chargers. Working together, the Impres system,

- Tracks and displays current battery capacity.
- Reduces charge cycles to maximize talk time.
- Extends battery life using automatic conditioning.
- Provides cost savings through less frequent battery replacement.

Adjacent Control Channel Outbound Signaling Packet

In an ASTRO 25 trunking system, Motorola radio units maintain a list of the adjacent sites. Each RF site (ASTRO Repeater site and simulcast subsystem) in wide area trunking mode transmits a series of Outbound Signaling Packets (OSPs) containing the following:

- Zone/site identification.
- Active control channel of adjacent sites.
- Alternate control channels at the current site.
- Channel resource capabilities.

When a Motorola radio is registered with a site, the adjacent site list is updated with the information obtained from the Adjacent OSPs on the Control Channel (CC) and Link Controls (LCs) on assigned channels from that site.

By periodically monitoring the status of the surrounding sites, users maintain a consistent level of communications because the radio automatically selects the optimal site providing the highest level of audio quality available.

After being registered on a site, and during a period of inactivity on the control channel, the radio will periodically scan the internal list of potential control channels at adjacent sites. The radio performs this control channel scan to determine the current signal strength of the control channel at the adjacent sites. Depending on the strength of the new signal, the radio may either attempt to register on the new site, or it may simply remember the new site signal strength and remain on the original site to which it is registered. By repeating this process a number of times, the internal list of potential control channels will be updated with relative signal strength measurements.

Automatic Site Registration

Site Registration is the automatic registration process that takes place when a radio roams from one site to another, which is transparent for the user.

On power up, or selection of a new system, the radio must do a Full Registration. Once completed, a procedure is used by the Motorola radio to inform the Fixed Network Equipment (FNE) of its current location upon roaming to a new site. The system tracks the location of each radio user making site switching more efficient and reducing system traffic overhead.

Radio Deregistration

Deregistration of a radio unit occurs in two forms:

- Radio activated
- Timeout activated

Radio activated deregistration is a radio function that sends in a deregistration signal to the system when turning off power or going to another trunking system or conventional personality.

Timeout activated deregistration occurs when no activity has been seen from a radio for a pre-selected time. When the timeout occurs, the radio is deregistered. Radios are polled after timeout occurs. If the radio responds to the polling, the timer is restarted. The timeout period is programmable by talkgroup, allowing the Zone Controller to conserve channels for future calls.

Dynamic Network Access Code (DNAC)

The dynamic network access code is used to reduce co-channel and co-site interference. The radio decodes the Network Access Code (NAC) associated with the control channel at a site and uses it for both transmit and receive on the ASTRO 25 voice channel at that particular site. NAC serves as the ASTRO 25 equivalent of connect tone. Each site can have one of the 16 unique NACs allowed within the system. Interference protection is provided from nearby systems as well as between sites in the customer system.

Preferred Site Operation

Preferred Site Operation allows a radio to use an additional site ranking criteria to select an alternative, pre-programmed preferred site in trunking mode. Signal quality measured by the radio is used to determine what the radio should do in preferred site operation. The combination of the signal quality reading and the preferred site status results in the "site ranking" for that site. Preferred status allows a system administrator to better manage the capacity and traffic of their system, increasing availability of system resources to users in the field.

There are four variations of preferred site status:

- ***Always preferred*** – In all modes, the radio unit remains affiliated, always using this site if it has an acceptable signal quality.
- ***Preferred*** – In wide area trunking, the radio unit uses this site if it has an acceptable signal quality rating.
- ***No preference site*** - The radio unit uses the site with the best signal. This is the default setting for radios.
- ***Least preferred*** - The radio unit only uses this site when no other sites with an acceptable signal quality are available for use.

Site Trunking Indication

Radios detect if a site is in wide area trunking or site trunking. Radio models with a display will indicate to the user when the site is operating in site trunking. The radio alternately displays the selected talkgroup and “Site Trunking”.

User Initiated Site Search

This Motorola radio feature allows the user to manually search for the site with the next best signal quality.

Site Lock/Unlock

This Motorola radio feature allows the radio to lock onto a specific site and not roam among wide-area talkgroup sites.

Failsoft by Talkgroup

Subsystem/Site Failsoft is a fall back means of communication if a site no longer maintains wide area or subsystem trunking operations. Failsoft operation provides communications via repeaters/base radios in order to maintain vital communications. Each talkgroup is associated to a given frequency, the radio checks the frequency associated with its current talkgroup first. It also allows some balancing of radios across the various channels at a site and provides some basic group partitioning. Alternately, the control channels are the default Failsoft channel for each subsystem/site.

4.3.3.2 Simulcast Operation

A simulcast land mobile radio system provides continuous coverage over a large geographic region using a single set of frequencies. Simulcast solutions extend a system's RF coverage, especially in areas where available frequencies are limited, and in areas where physical barriers (e.g. mountains and buildings) can cause reduced signal coverage.

Trunked simulcast was developed by Motorola to meet the needs of users who were outgrowing their single-site radio systems. Simulcast offers the following advantages:

- ***Improved Coverage*** – One radio site may not provide the coverage necessary for the application in question. Simulcast expands the coverage area by expanding the number of radio sites without adding additional frequencies.
- ***Efficient Use of Frequencies*** – Adding sites typically requires more frequencies. In a simulcast system, the same frequencies are used at every site in the system. This makes very efficient use of the available spectrum.
- ***Simplified Radio Operations*** – Because the simulcast architecture operates like a single-site system, operations are simplified and radios are easy to use.

4.3.3.3 User Talkgroup Features

To enhance user functionality, the ASTRO 25 platform has many talkgroup features, as described below. These features are configurable by the System Administrator.

Emergency Alarm/Call

Emergency alarm/call provides users the capability to inform dispatch personnel of a life-threatening situation. By pressing the radio's emergency alarm button, an audible and visible alarm and the user's ID are sent to the dispatcher, and optionally all talkgroup members.

In emergencies, the dispatch center is notified immediately, regardless of whether the system is busy. If one or more voice channels are available, one of those channels will be assigned immediately to the emergency call when the user presses the PTT switch. The duration of the emergency call can be defined by the system administrator.

In the event that the system is busy, two alternatives are provided for handling emergency traffic:

- ***Top of the Queue*** – When an emergency is initiated and no channel is available, the emergency user is put at the top of the busy queue. As soon as the first user on any channel de-keys, the emergency caller is assigned that channel. The major advantage to this approach is that there is no contention for the channel.
- ***Ruthless Preemption*** – When an emergency is initiated and no channel is available, the Zone Controller selects the channel assigned to the lowest priority user and assigns it to the emergency caller – a feature unique to Motorola trunking systems.

Multiple Priority Levels

The system provides 10 priority levels, allowing administrators to segment their users according to their communications needs. Priority 1 is always reserved for emergencies. Priorities 2 through 10 can be assigned by the System Manager on a per radio or talkgroup basis. These priorities are only applicable when the system is busy.

Multi-Group Call

Multi-group call is used to make a simultaneous call to multiple talkgroups, and allow all units to be configured for talk back capability. The System Manager can program this call to operate in one of two ways:

- The requesting user waits for all requested talkgroups to finish all calls in progress.
- The requested call immediately interrupts other conversations in progress without waiting for active users to de-key. Radio users who are transmitting on a voice channel will not hear the call until they de-key.

Dispatch Console/Talkgroup Merge

Talkgroup merge is a dispatch function that allows multiple talkgroups to operate together on one voice channel, improving channel efficiency. This is a standard feature of Motorola wireline consoles.

Priority Monitor

Priority monitor allows the radio user to scan talkgroups in their system, and mark up to two talkgroups in their scan list as Priority. A non-priority conversation will be interrupted by Priority 1 or Priority 2 talkgroup activity.

4.3.3.4 Individual Call Features

To further enhance user functionality, the ASTRO 25 platform has individual call features in addition to user talkgroup features, as described below. These features are configurable by the system administrator.

Call Alert

Call Alert allows a dispatcher or radio user to selectively page an individual's radio. Call Alert signaling is conducted over the control channel and does not affect voice channel capacity. The Call Alert produces an audible and visual alert on the receiving radio. Indicators on the initiating radio acknowledge delivery of the Call Alert. If the receiving unit has a display, it will show and store the sending unit's ID.

In-Call User Alert

In-Call User Alert is a feature that builds upon Call Alert. When In-Call User Alert is enabled on the system, radios will be able to receive Call Alerts even when involved in voice and data services.

Radio Talkgroup Muting

Radio Talkgroup Muting is a feature that utilizes the Call Alert feature. Radio Talkgroup Muting allows the radio user to mute all voice traffic for the currently selected talkgroup.

The radio can be automatically un-muted by the console dispatcher or another radio user by sending the muted radio a Call Alert. With In-Call User Alert enabled, the Call Alert will reach the muted radio when it is on the voice channel or a data channel, as well as if it is idle on the control channel.

Private Call

Private Call allows a radio user or console dispatcher to selectively call and carry on a private conversation with another individual radio, as long as that unit is not already engaged in another Private Call. The calling unit will receive an acknowledgment of a successful Private Call. If the receiving radio has a display, it will show the calling party's unit ID.

Telephone Interconnect

The telephone interconnect feature allows selected radios to make and receive phone calls. Telephone interconnect provides a temporary connection to a landline telephone through the radio system. Telephone interconnect allows radio users to call a telephone number from the field.

4.3.3.5 Encryption Capabilities

When it's absolutely critical that communications not be monitored by unauthorized parties, radio systems can be configured with encryption. Encryption assures that only authorized units in the system can listen to transmissions being made. Encrypted calls are protected end-to-end throughout the network.

Project 25 Encryption Algorithms

ASTRO systems can be equipped with current Project 25 algorithms, and fully compliant with all Federal Information Processing Standards (FIPS).

Software-Based Encryption Algorithms

Advanced Digital Privacy (ADP) is an entry-level encryption algorithm, offered exclusively by Motorola. ADP allows users to protect any and all communications from eavesdroppers and scanners at a cost much less than the hardware-based encryption algorithms. With Health Insurance Portability and Accountability Act (HIPAA) compliance being more closely scrutinized, many users are implementing this cost effective security option for all of their users.

Over-the-Air Rekeying

Over-The-Air Rekeying (OTAR) provides all the features of multikey (multiple keys) and enables you to distribute encryption keys over the air without physically touching the radio. OTAR is designed to work on the IV&D transport layer.

Encryption is configured by distributing unique keys to designated user(s). OTAR eliminates the burden of manually rekeying your radios on a regular basis. It enables key distribution and key management to be conducted securely over-the-air.

Key Management Facility (KMF)

The Key Management Facility (KMF), a centralized key manager, is the essential key management controller for Motorola's Project 25 Over the Air Rekeying (OTAR) feature. Utilizing the KMF, information can easily be created, inventoried, archived, and distributed to end-users. Combining centralized key management with our standards-based OTAR capability enables effective planning, implementation, and execution of robust security procedures.

4.3.4 ASTRO 25 Network Management System Components and Features

4.3.4.1 Network Management System

The Network Management System (NMS) can be viewed as a set of software applications or tools used to manage the ASTRO 25 wide area trunked radio system and its constituent components.

The NMS supports the following services:

- ***Network Monitoring*** – Applications are included for monitoring the status of the transport network and the individual infrastructure components; displaying status information; forwarding alert information; and performing diagnostic procedures.
- ***Configuration Management*** – Facilities are provided for entering and maintaining the operational parameters of the infrastructure components and user devices (i.e., the mobile and portable radios).
- ***Accounting Management*** – NMS supports the tracking of radio usage of the system by providing an optional interface to third party accounting and/or billing applications.
- ***Performance Management*** – Standard and optional applications are available for monitoring, reporting, controlling, and optimizing the use of system resources.
- ***Security Management*** – NMS includes features for setting user privileges and controlling their access to view and/or modify information contained in the configuration databases.

The NMS subsystem can include the following servers at the zone and system levels of the ASTRO 25 system.

- NMS Zone-level Servers (one each per zone): Air Traffic Router, Zone Database Server, Unified Event Manager (UEM), Zone Statistics Server, and User Configuration Server (UCS).

Details of the NMS servers included in your system are discussed below.

Air Traffic Router (ATR)

The ATR hosts a variety of real-time, data processing applications to support user and system applications. The ATR server receives air traffic information from the Zone Controller, creates Air Traffic Information Access (ATIA) packets, and sends them to the customer server that is located on the customer network. This includes processing real-time call transactions, sourcing Air Traffic Information Access (ATIA) data stream to third-party applications, logging all ATIA data to disk, routing Radio Control Manager command and status packets to/from the Zone Controller, and routing call logging packets from the Zone Controller to the Statistics servers.

Zone Database Server (ZDS)

The ZDS handles a variety of tasks; including hosting the zone configuration database, administering applications licenses, authenticating network manager users accessing the system, and performing back-end support for user applications.

The Zone Database Server (ZDS) performs the following database server functions:

- Maintains the infrastructure (zone configuration) database for the zone.
- Exports the infrastructure information from its database to the Zone Controller where it is stored as the local infrastructure database.
- Maintains a replica of the current UCS database and home zone map.
- Exports the radio information it receives from the UCS to the Zone Controller.

The ZDS also performs all network management and fault management polling of system devices to support the network management clients. The fault management information that the ZDS collects is passed on to the FullVision® Integrated Network Management (INM) server.

The ZDS handles a variety of administrative tasks, including the following:

- Administering the standard and optional applications licenses.
- Authenticating network manager users accessing the system.
- Performing back-end support services for user applications.
- Handling telephone interconnect record processing.

Zone Statistics Server (ZSS)

The statistics server is the data repository for data statistics necessary to drive Historical Reports. Statistics such as the number of calls, push-to-talks, and busies are accumulated over preset time intervals.

User Configuration Server (UCS)

The UCS provides database storage and back-end processes required for most system-wide functions. The UCS makes it possible for management personnel to configure home zone maps, users, radios, talkgroups, critical sites, Adjacent Control Channels (ACC), security information at a system-level, and other system-level parameters. Group and Unit ID home zone assignments are also made at the UCS level. This information is configured using the User Configuration Manager (UCM) application and is saved in the UCS database.

4.3.4.1.1 Unified Event Manager (UEM)

The UEM provides a central location for managing all radio, transport, and environmental devices on the system (Figure 4-13). The application automatically discovers devices on the network to determine their real-time status. Color-coded symbols displayed on a topography map provide a geographical and hierarchical representation of the entire network. The UEM allows each user to filter out and customize the pertinent information important to their roles and responsibilities.

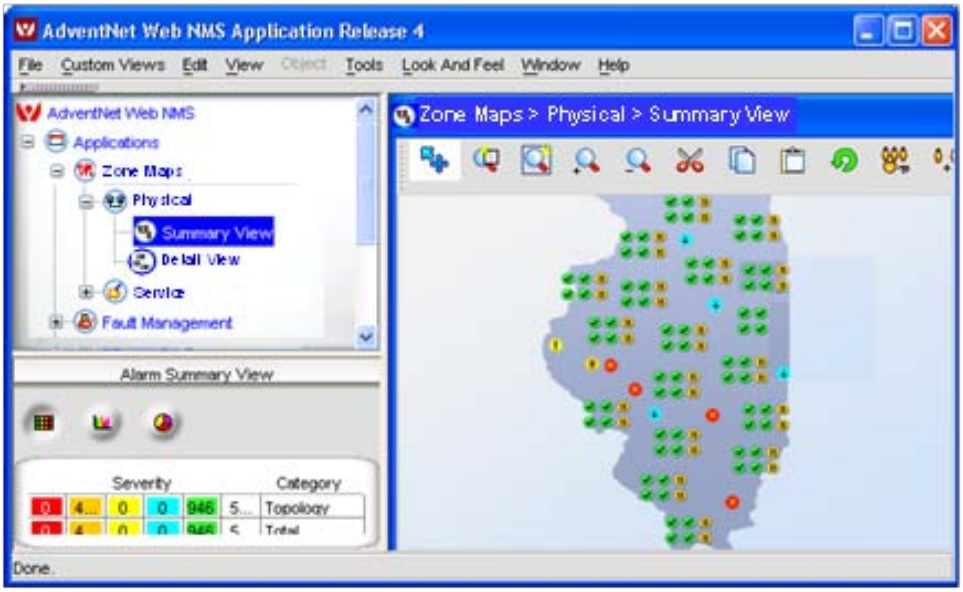


Figure 4-13: UEM application window

Features and benefits of the UEM are outlined in Table 4-23.

Table 4-23: Benefits of the UEM

Feature	Benefit
Centralized View of Entire Communications Network	Network Managers can view the entire ASTRO 25 system status and quickly isolate problems to the board level.
Intuitive Graphical User Interface (GUI)	Network Managers can be quickly notified of failures on the system and diagnose device problems, utilizing a display and an intuitive GUI.
Auto Discovery of Devices	Components are automatically discovered and map views are created to show the overall health of the network.
Active Alarms View and Alarm Summary	Persistent single view all failure conditions in the network and a quick reference summary of alarms by severity allows users to quickly pinpoint the highest priority failures
Secure Device Access	SNMPv3 protocol with Triple DES and AES 256 bit encryption to prevent security breach attempts
Northbound Interface	Real time event stream using a standard industry protocol that can be used to forward events to a higher-level management application for added flexibility.
Email Notifications	User specified event notifications sent via email – which could also be forwarded to a portable mobile device – allows System Managers to simultaneously address other tasks
Network Monitoring Capabilities	Archive and export event history data for analysis
Remote Command Operation	Remote state change capability helps to avoid unnecessary sites trips

The Unified Event Manager (UEM) gives the Network Manager virtually instantaneous notification of any system deficiency or element failure.

UEM Event Browser

Figure 4-15 illustrates the UEM Event Browser screen.

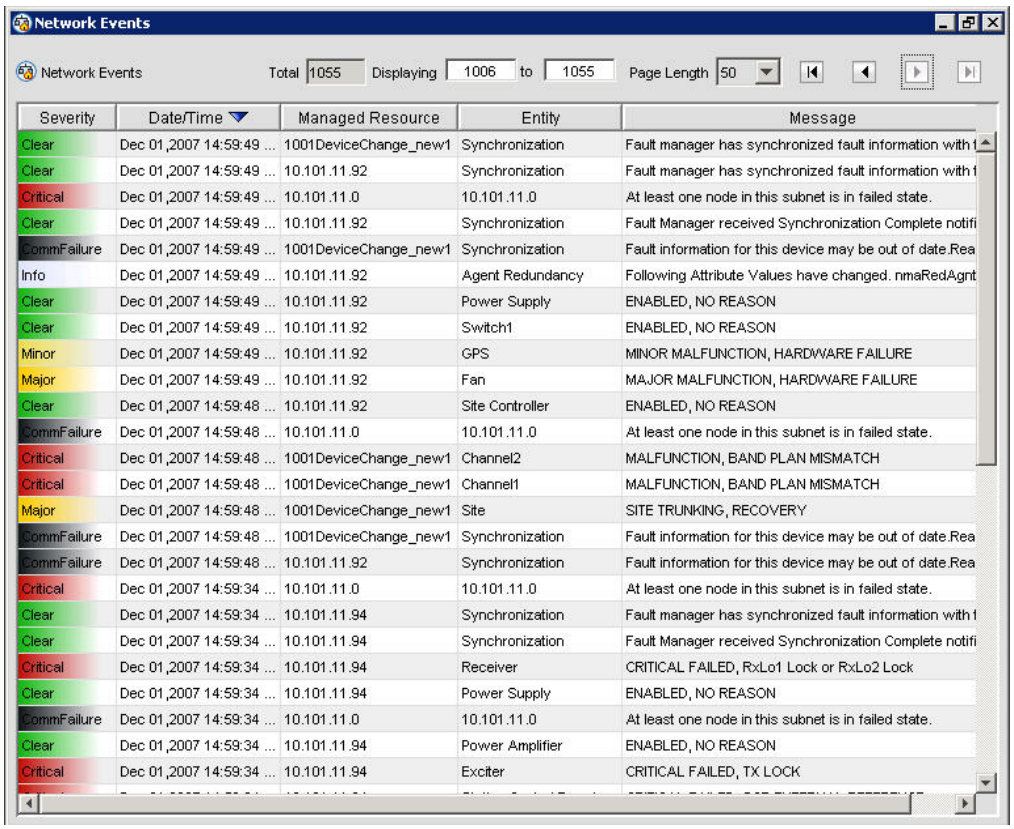


Figure 4-14: UEM Event Browser Sample Screen

The UEM event browser (Figure 4-14) provides a way to look at all the events (or a filtered subset of events) that are received by UEM. By default, when viewing an event, the event browser displays Severity, Date/Time, Managed Resource, Entity, and Message. Additional display properties are available. Up to 10,000 of the most recent events from any managed device within a zone can be displayed.

UEM Alarm Browser

The UEM alarm browser (Figure 4-15) allows the user to view all alarms, or a filtered subset of alarms. By default, when viewing an alarm, the alarm browser displays Severity, Date/Time, Managed Resource, Entity, Message, and Owner/Assignee information. Additional display properties are available. UEM supports exporting events and alarms for future analysis.

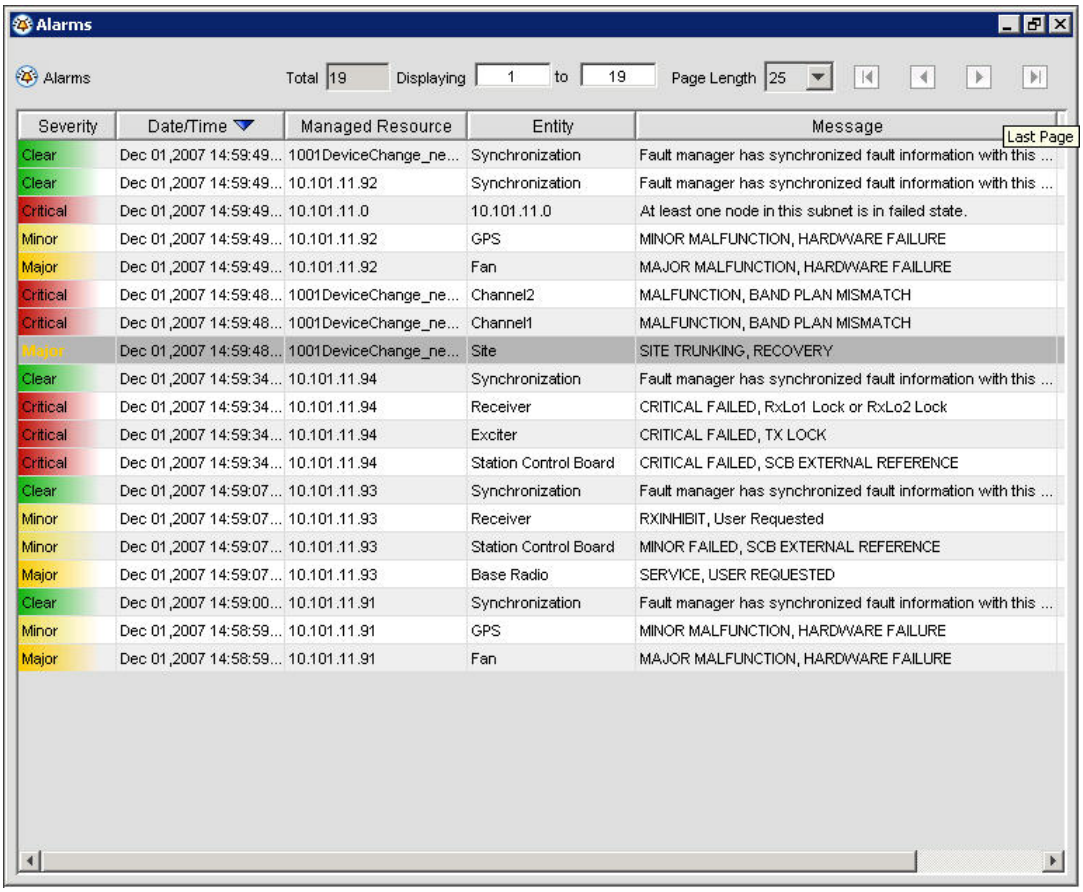


Figure 4-15: UEM Alarm Browser Sample Screen

4.3.4.2 Network Management Terminals

The NMS Windows-based client/server architecture distributes most of the user application processing to the client PC workstations. The following applications run on or may be accessed from the Network Management terminal:

- System Profile
- User Configuration Manager
- Software Download
- Historical Reports (System-level)
- Zone Profile
- Zone Configuration Manager

- ZoneWatch
- Affiliation Display
- Air Traffic Information Access (ATIA) Log Viewer
- Dynamic Reports
- Historical Reports (Zone-level)
- Fault Manager using FullVision Integrated Network Manager (INM)
- FullVision Administration
- FullVision Web Browser
- Radio Control Manager (RCM)
- Radio Control Manager Reports

4.3.4.3 Alarm and Control Equipment (MOSCAD)

The Motorola Supervisory Control and Data Acquisition (MOSCAD) Graphic Master Central (GMC) coupled with the MOSCAD Remote terminal Unit (RTU) creates a fault management subsystem that ports non-SNMP alarms, such as environmental alarms, over to the SNMP alarming system (FullVision/UEM). MOSCAD also provides control capabilities through dry-contact relays, and limited programming capabilities to non-IP-based site equipment such as channel banks, microwave equipment, GPS receivers, and legacy base stations.

Detailed graphics and display logs allow more information to be displayed on devices monitored by the MOSCAD RTU. Geographic displays and “front panel” views of remote site equipment permit enhanced recognition of component problems and simplifies customer operator training. Custom graphics allow easy navigation from high-level geographical system view down to individual site details.

All events, alarms, and control actions are time timed, stored in the appropriate files, and can be printed for hard copy record keeping. History files allow for retrieval of information at all times.

4.3.4.4 Network Management Features

Flexible Air Traffic Information Access (ATIA)

The Flexible ATIA interface feature provides an access point for air traffic call information. Customers can generate detailed billing reports or management reports with third-party products or services.

Security Partitioning

This feature allows the creation of security groups in order to limit access to selected database records. It allows system administrators to control access to network management data by department, geography, or individual user.

Dynamic Shared Services Algorithm

This feature controls the sharing of voice channels between voice dispatch and telephone interconnect service based on real-time calculations of current system

loading. It controls both the maximum number of simultaneous telephone interconnect calls as well as the maximum length of an interconnect call.

Radio Control Manager

The Radio Control Manager (RCM) application provides the ability to generate radio commands and to display radio events. Users also have the capability to generate RCM reports. Some features of the RCM are:

- ***Dynamic Regrouping*** – Allows a dispatcher or system manager to dynamically program an affiliated radio user to a particular talkgroup. The radio will generate an audible noise indicating to the user that the radio has been regrouped.
- ***Storm Plans*** – Provide the system with an automated, predefined procedure for special or emergency situations.
- ***Selective Radio Inhibit*** – Denies system access to lost or stolen Motorola radios. When a radio is reported missing, a network management terminal operator can send a Selective Radio Inhibit command to the system controller, rendering the radio unit inoperable. Once found, the radio can be reactivated and restored to normal operations over the air.

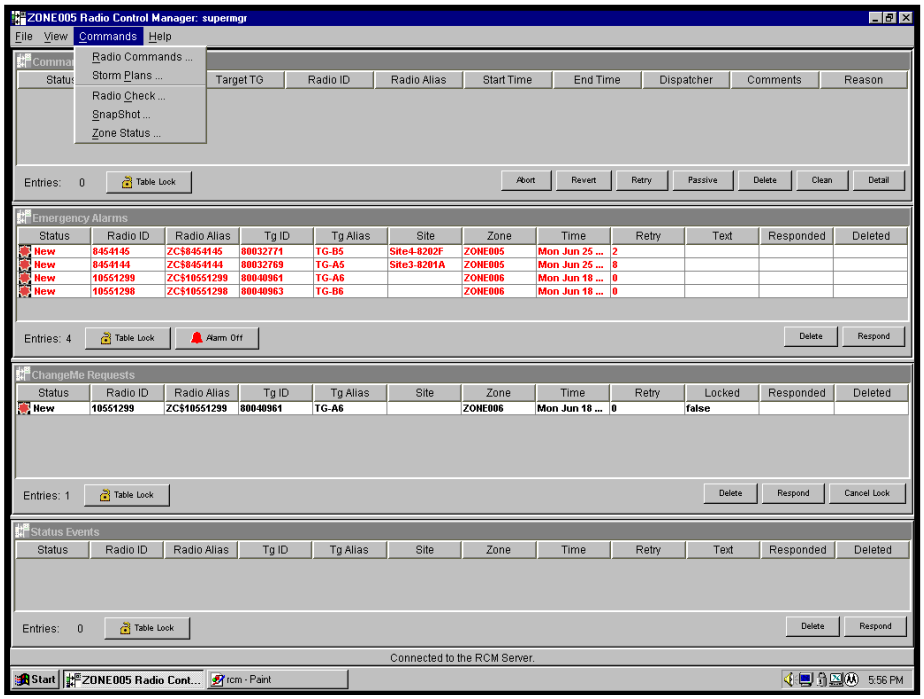


Figure 4-16: Sample Radio Control Manager Screen

ZoneWatch

Our customers say ZoneWatch is the single most important application for real-time monitoring of their network.

ZoneWatch provides customizable displays and graphs to monitor real-time communications activity and network health. It is a set of diagnostic tools allowing individuals to make more efficient system management decisions. An administrator-defined display of information can be created down to individual unit or talkgroup activity.

- At a glance, provides a real-time snapshot of the system
- Color coded display allows for quick network status indications
- Enables faster identification and resolution of potential issues

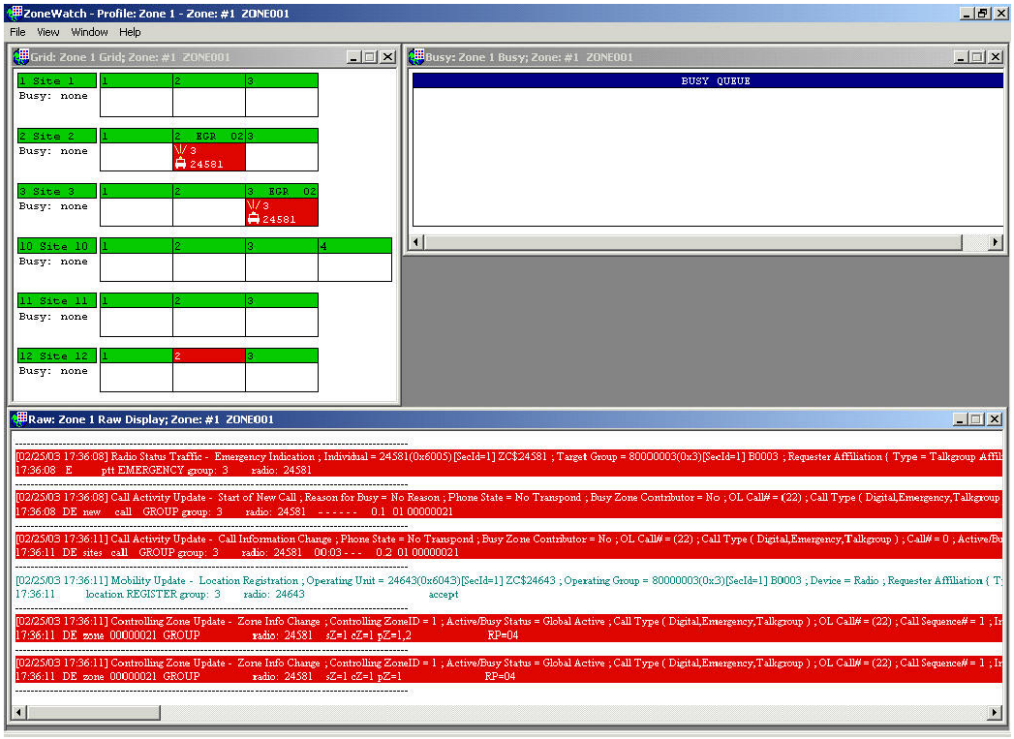


Figure 4-17: ZoneWatch Control Display Example

Channel Partitioning

The Channel Partitioning feature provides agencies or departments, with exclusive use of specific RF channels. The use of this feature allows the segregation of one set of users from another to ensure dedicated resources for a specific group.

Affiliation Display

The Affiliation Display provides a dynamic view of the sites to which all operating units are currently affiliated, making it easy to track and troubleshoot radios in the system. Specifically, it provides a dynamic view of:

- Sites.
- Talkgroups.
- Individual Radios.

This allows a manager to understand the loading characteristics of their system in real-time. Graphing capabilities are also included. Figure 4-18 provides a selected site graph example.

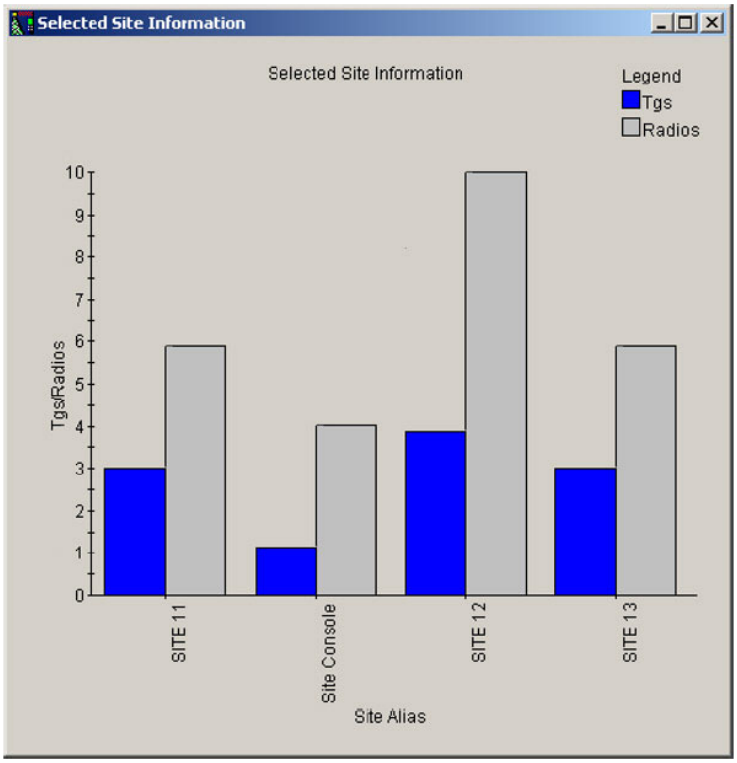


Figure 4-18: Selected Site Graph Example

Dynamic Frequency Blocking

When frequencies are sparse, Dynamic Frequency Blocking allows you to reuse frequencies in close proximity within the system. This feature automatically allows the system to dynamically block the frequency at site A while transmitting the same frequency at site B.

Alphanumeric Paging

Alphanumeric Paging forwards user configurable system alarms through a customer selected paging service, providing real-time alerts to designated personnel.

SNMP Trap Forwarding

Forwards alarms received by FullVision to your SNMP management system, allowing your existing network to actively monitor alarm conditions within the radio network.

Northbound Interface

Forwards alarms from the Unified Event Manager (UEM) application allowing your existing network to actively monitor alarm conditions within the radio network.

Email Alerting

Email alerting sends notifications for system alarms in the Unified Event Manager (UEM) to a specified email address. Alarms can also be forwarded to a mobile device such as a cell phone or PDA.

4.3.4.5 Network Monitoring

The ASTRO 25 platform's suite of network monitoring applications continuously monitors the health and status of all network devices and applications, providing network managers instant visibility to status changes throughout the network. The applications include:

- ***Hardware Element Monitoring*** – The radio system monitors and reports the status of all the hardware elements in the network.
- ***Software Process Monitoring*** – The system monitors and reports the status of all the critical software processes running on the various hardware elements. If a change in a software process is detected, self-healing actions may be initiated to correct the process. Refer to the Self-Healing Actions feature for more information.
- ***Network Link Integrity Monitoring*** – Any changes in the network links are reported to the radio system's fault manager.
- ***SNMP Trap Forwarding*** – The system supports the reporting of status to the radio system's network manager via the SNMP protocol.
- ***Self-Healing Actions*** – The system automatically takes actions to remedy errors detected by its fault management routines to ensure continuation of critical communications.

4.3.4.6 System Reporting

ASTRO 25 provides users with numerous reports, which provide historical and real-time traffic data to aid in system optimization, allow system managers to view real time call activity to be proactive in making resource-planning decisions, and monitor system usage by identifying the sites that are used the most and determining where radio users are located throughout the system.

Historical Reports

ASTRO 25 allows users to manually or automatically generate historical performance reports using standard templates contained.

The Historical Reports application generates reports of statistical data that is gathered at specific, predefined time intervals. Users can then create reports from this data to monitor and analyze information about zones, sites, channels, talkgroups, and users. This data is displayed using predefined report templates and parameters.

Figure 4-19 shows an example of a Historical Report.

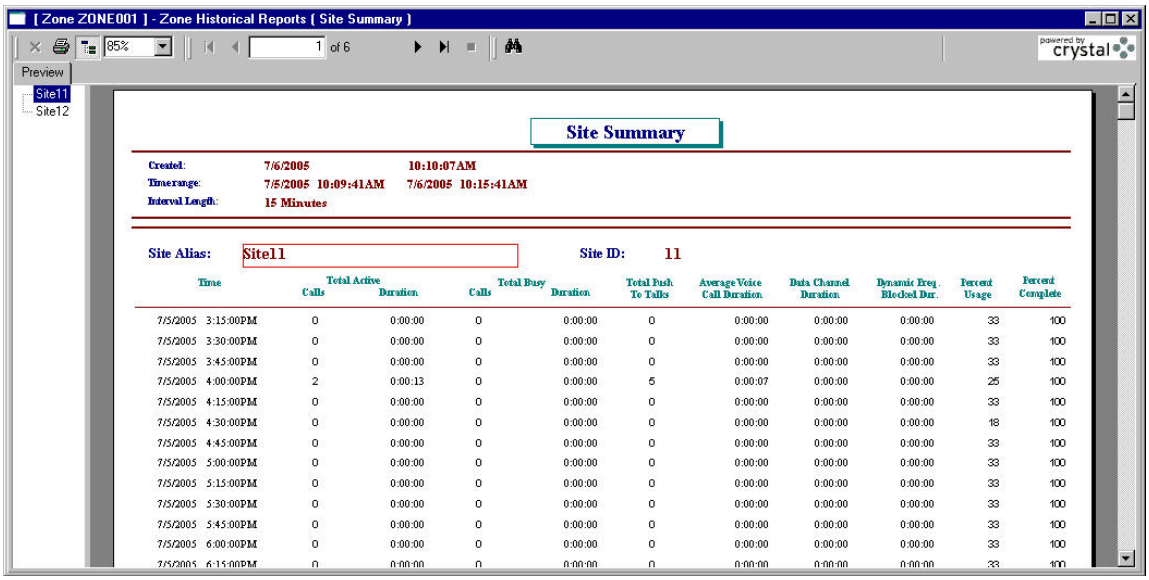


Figure 4-19: Historical Reports Example

Dynamic Reports User Licenses

ASTRO 25 allows users to generate near real-time graphical reports showing system utilization for talk group, private, and interconnect calls.

Dynamic Reports provides several predefined report templates that can be used to display statistics for a zone, site, or a console site (but not for a system) in near real time. Some of these include:

- ***Templates for Zone-Level Reports*** – Dynamic Reports allows you to create and run reports to capture statistics across a zone. For example, the Zone Call Activity report provides statistics for determining the levels of different call activities within the zone, such as call rejects or call terminations.
- ***Templates for Site-Level Reports*** – Dynamic Reports allows you to create and run reports to capture statistics across a site. For example, the Site Busy Count report provides statistics for determining the number of busies caused by lack of resources at this site or the number of busy calls originating at this site.
- ***Templates for Console Site-Level Reports*** – Dynamic Reports allows you to create and run reports to capture statistics across a console site. For example, the

Console Site Link Bandwidth Usage report provides the percentage of bandwidth to a console site consumed by trunking calls in the time interval.

An example of a Dynamic Report for Zone Call Activity is shown in Figure 4-20.

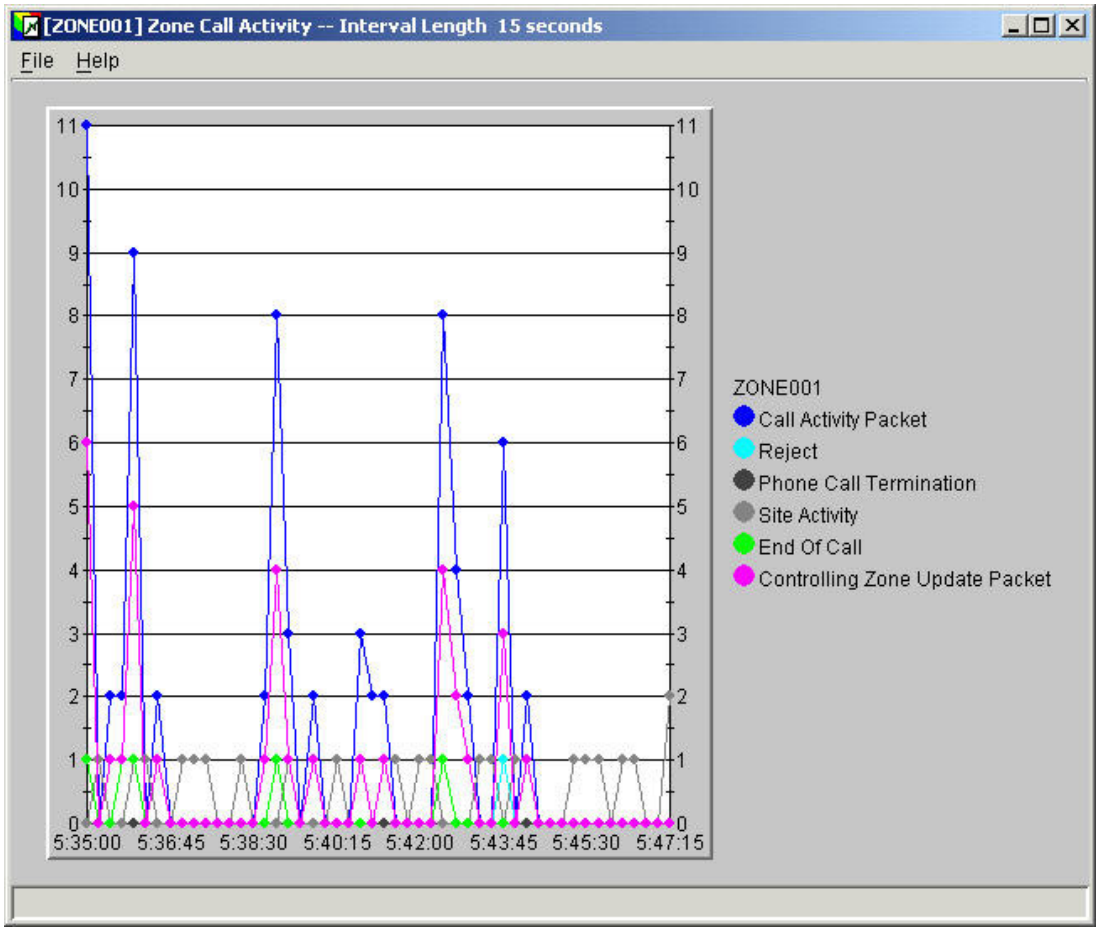


Figure 4-20: Example of Dynamic Report: Zone Call Activity

Custom Reports

Custom Reports lets you create or modify reports to meet your specific needs using the statistical data elements supported by the Performance Reports application. This can be applied for either Historical or Dynamic Reports. The Custom Report is created using the Crystal Reports® application and is an optional feature of the ASTRO 25 platform.

Affiliation User Reports

Affiliation User Reports allows a user to observe selected real time affiliations in the zone for sites, talkgroups, or individual radio users. Also provides graphing capabilities.

Radio Control Manager Reports

Radio Control Manager (RCM) Reports let you create and view standard reports from the following categories:

- ***Emergency Alarms Reports*** - Provides a historical listing of all Emergency Alarms received by the RCM in a selected period of time. The report can display all Emergency Alarms in the active or historical events queues. These reports include:
  - Emergency Alarms by Radio Report
  - Emergency Alarms by Talkgroup Report
  - Emergency Alarms in the Deleted State Report
  - Emergency Alarms in the Responded State Report
- ***Current Login Sessions Reports*** - Provides information about the RCM users currently logged into the system.
- ***Radio Command Reports*** - Shows the commands that have been sent to radio users, such as Regroup, Inhibit, and Selector Lock. These reports include:
  - Radio Commands by Command Report
  - Radio Commands by User Report
  - Radio Commands by Radio Report

Motorola systems are designed with expandability and future migration in mind. ASTRO 25 is an IP Standards Based scalable platform. This fact, in conjunction with our experience in designing and implementing solutions to specifically address your needs, makes us uniquely suited to solve your current communications needs as well as providing a foundation for your future growth.

The ASTRO 25 platform can support the maximum number of zones, sites, and channels shown in Table 4-24.

Table 4-24: ASTRO 25 System Expandability

ASTRO 25 System	Multi-Zone Capacity
Zones	1-7
RF Subsystems	100/zone
Channels	700/zone
Simulcast Cells	64/zone
Sites per Cell	15
Dispatch Sites	55/zone
Unit IDs	64,000
Affiliated Users	64,000
Talkgroup	16,000
Data Users	20,000
Dispatch Positions	2,000

4.3.5 MCC 7500 Dispatch System Description

The MCC 7500 console features an intuitive, GUI that operates under the Microsoft Windows® platform and follows the same standards as other Windows programs around the world. The screen layout is simple and uses valuable space efficiently. Key information and critical functions are clearly identified with easy to understand icons. Dispatchers can quickly recognize these icons instead of reading text, hence maximizing their productivity.

Many tasks can be completed more quickly and easily than ever before with the MCC 7500 consoles. Channels or talkgroups are displayed in on-screen "folders" for prioritization. Flashing red indicators easily identify incoming emergencies. Dispatchers can see information about who is calling, such as the time and call type. Trunked callers can be identified by real names versus numerical IDs.

4.3.5.1 Architecture Overview

The MCC 7500 dispatch console is Motorola's IP high-tier radio dispatch console system designed for use in our ASTRO 25 trunking systems.

Some of the more important features of the MCC 7500 console include:

- Seamless integration with ASTRO 25 trunking systems:
  - Supports the IP protocols of the trunking system's transport network; no circuit-switched network to packet-switched network conversion equipment is necessary.
  - Encryption and decryption is performed within the dispatch consoles, which allows true end-to-end encryption in the radio system.
  - Participation in the radio system's agency partitioning functionality.
  - Configuration of the console subsystem via the radio system's centralized configuration subsystem (Network Manager) so the user has a single point to configure the radio system. The configuration subsystem may be accessed from multiple remote locations so users can still have convenient access while enjoying the benefits of centralized configuration.
  - Management of the console subsystem via the radio system's centralized network management subsystem so the customer has a single point for managing faults, accounting, performance, and security of the radio system. The network management subsystem may be accessed from multiple remote locations so customers can still have convenient access while enjoying the benefits of centralized management.
- Centralized and/or distributed logging of conventional and trunked radio audio associated radio call information and certain radio system events.
- Higher capacities in numerous areas (64,000 talkgroups, thousands of logging "tracks").

4.3.5.2 Connection of MCC 7500 to IP Network

Motorola MCC 7500 console equipment connects directly to the trunking system's IP transport network. It uses the IP packet protocols for passing call control data and call audio through the system.

Elite Dispatch GUI

The MCC 7500 dispatch console uses the Elite Dispatch GUI for displaying information to and accepting commands from the dispatch console user. The Elite Dispatch GUI is efficient, easy to use and intuitive, having been refined and proven through years of use in public safety dispatch centers around the world.

An example of the Elite Dispatch GUI is shown in Figure 4-21.

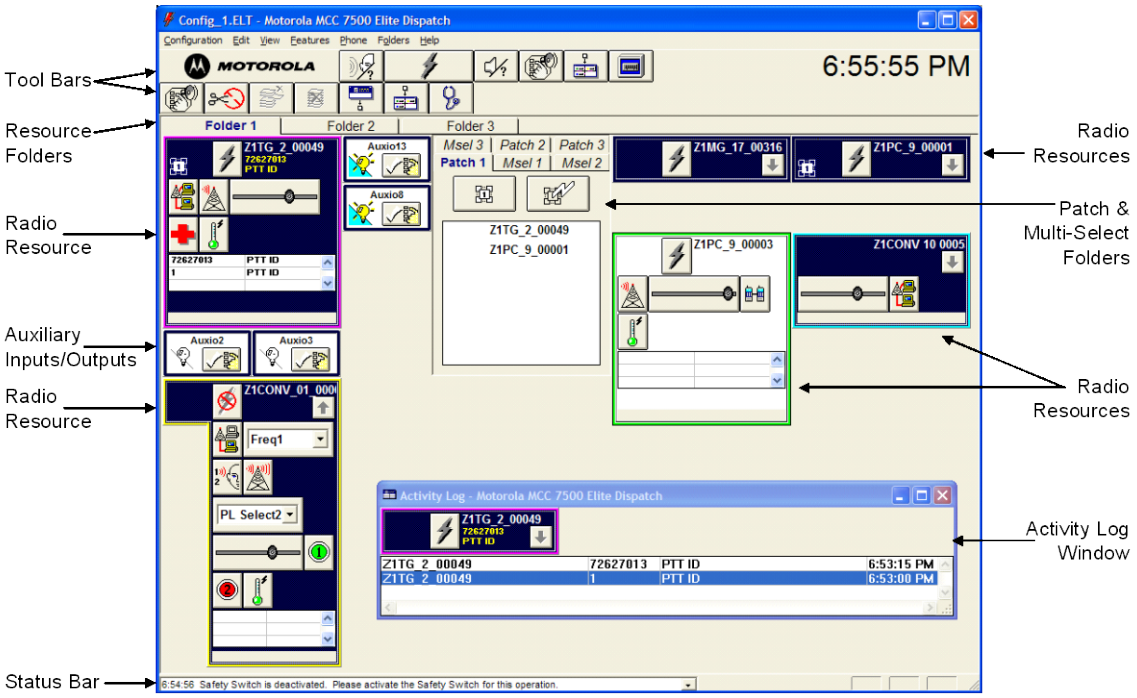


Figure 4-21: Elite Dispatch GUI

The Elite Dispatch GUI is based on Microsoft Windows GUI programming standards and contains many controls, displays, and features, which are familiar to anyone who has used Windows-based applications. These features are described in detail in the following sections.

Pull Down Menus

The Elite Dispatch GUI provides the following pull down menus on a menu bar across the top of the dispatch window:

- Configuration – Provides access to the configuration files used by the Elite Dispatch GUI. Also allows the dispatch application to be exited.
- Edit – Allows various aspects of how audio, resources, and features are presented to the user on the Elite Dispatch GUI to be edited. Changes made using this menu are not permanent and are lost when the dispatch application is exited.
- View – Allows the dispatch console user to control whether or not the Activity Log and Auxiliary I/O Windows are shown.
- Folders – Allows the dispatch console user to switch between folders, add folders, and change the folder tab width. Changes made using this menu are not permanent and are lost when the dispatch application is exited.
- Help – Provides access to detailed on-line help for using the Elite Dispatch GUI.

The user may customize which menus are displayed and what they contain via the Elite Admin application.

Toolbars

Up to two toolbars may be present across the top of the dispatch window and may be used to provide quick access to frequently used features. The following are examples of the items that may be placed in the toolbars:

- Clock
- General Transmit Button
- Monitor Button
- All Mute Button

Many other items may be placed in the toolbars. The Elite Admin application is used to define how many tool bars are displayed and what they contain.

Status Line

A status bar is provided across the bottom of the dispatch window for viewing the status of the dispatch console as well as various error messages. The most current status or error message is displayed in the status line until cleared by the dispatch console user. The dispatch console user may scroll through the last 10 statuses/error messages to view them and may clear them by using the Features menu on the menu bar.

Resource Folders

The Elite Dispatch GUI provides up to twenty resource folders for organizing the various resources (radio resources, auxiliary input/output resources, etc) which are assigned to the dispatch console. These folders may be given descriptive names to simplify the organization of the resources.

The resources on a folder are displayed when the dispatch console user clicks on the folder tab. Resources on folders that are hidden behind the one being displayed continue to operate in a normal manner. Radio resource audio on a hidden folder appears in the appropriate speakers/headsets along with a visual call indication on the folder tab. If an emergency alarm or call is received on a radio resource that is located on a hidden folder, a visual emergency indication is displayed on the folder tab.

A resource may be placed on more than one folder at the same time. This allows customers to create folders for special situations without having to move resources back and forth between folders.

The Elite Admin application is used to configure how many folders appear on the Elite Dispatch GUI and which resources appear on each folder. It is also used to put descriptive names on the folder tabs.

During dispatch operations the dispatch console user may, if so configured by the Elite Admin application, be able to add, remove, or move resources on the folders. If this is done, these changes are not saved if the user logs off or changes configuration files for the dispatch application.

Up to 36 compressed radio resources may be viewed on one folder when the program is run in the standard 800 x 600 resolution and there is no patch or multi-select folders. If patch and multi-select folders are used and are set to the minimum height, then 31 compressed resources may be viewed. To figure the number of auxiliary input/output resources that could also be viewed, use the rule of thumb that two auxiliary resources can fit in the same space as one radio resource. In other words, instead of 10 radio resources, 20 auxiliary resources could fit in the same space. If the program is run in 1024 x 768 resolution, there is room for even more radio and auxiliary resources per folder.

Radio Resources

Voice communication paths in the radio system are represented as radio resources on the Elite Dispatch GUI. Radio resources are also referred to as “tiles” on the Elite Dispatch GUI. These radio resources are used by the dispatch console user to communicate on and control the radio system.

The following radio resources are supported:

- Trunked Talkgroups.
- Trunked Announcement Groups.
- Trunked Private Calls.
- Analog Conventional Channels.

Indicators and Controls

A radio resource contains indicators and controls that allow the dispatch console user to monitor and control various aspects of the radio channel. Examples of the indicators and controls that may appear on a radio resource include:

- Instant Transmit Button.
- Transmit Active/Transmit Busy Indications.
- Patch Active/Patch Busy Indications.
- Received Call Indication.
- Received Call Stack.
- Individual Volume Control.

The types of indicators and controls that appear on the radio resource depend on the type of radio channel it represents and how it has been configured in the Elite Admin application. The radio resource may be configured to always show the indicators and controls or to allow the dispatch console user to hide them when not in use to save space on the screen.

Compressed, Larger Compressed, and Expanded Resources

Figure 4-22 shows a radio resource that allows the dispatch console user to hide the indicators and controls. This is also called a “compressed” resource. Notice the small arrow button that allows the resource to be opened and closed to show the controls and indicators.

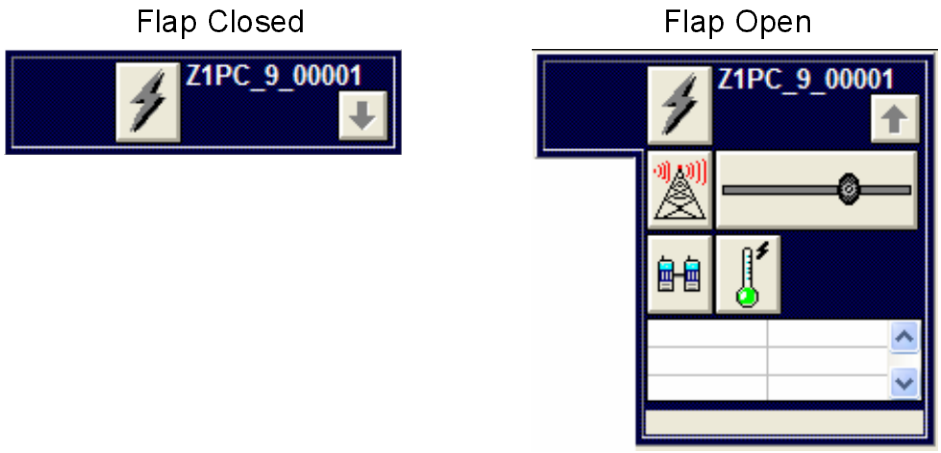


Figure 4-22: Compressed radio resource

Figure 4-23 shows a radio resource that always shows some of the indicators and controls, but allows the dispatch console to hide some of the others. This is also called a “larger compressed” resource.

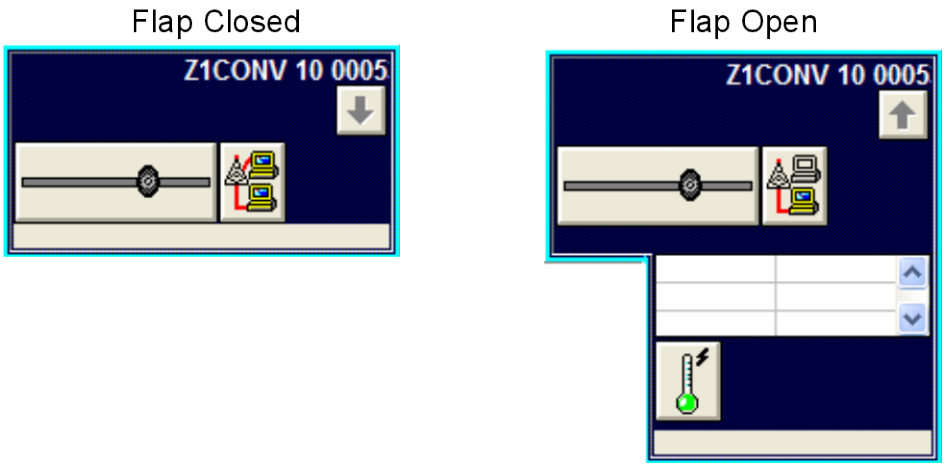


Figure 4-23: Larger compressed radio resource

Figure 4-24 shows a radio resource that always shows the indicators and controls. This is also called an “expanded” resource. Notice there is no arrow button on the resource.

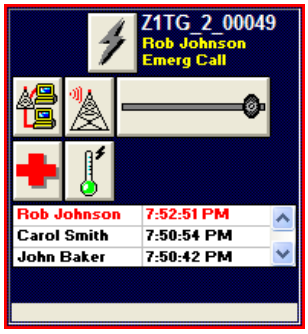


Figure 4-24: Expanded radio resource

Full parallel status for radio resources is reflected across all the dispatch consoles that have these radio resources assigned on them. That is, any activity or change on a radio resource appears on all dispatch consoles that have that resource assigned on them.

Received Call Stack

The received call stack provides the dispatch console user with a visual record of the most recent inbound calls on radio resources. This allows the dispatch console user to keep track of calls during busy traffic periods.

Outbound calls on radio resources from dispatch consoles (both the dispatch console containing the received call stack or parallel dispatch consoles) are not shown in the received call stack.

The calls are displayed in list format on a radio resource with the most recent calls at the top of the list. The number of calls displayed in the list is configurable as is the type of information displayed. The types of information that can be displayed are unit ID, unit ID alias, site ID, zone ID and, type of call and time. If an alias is available for a piece of information it is displayed, otherwise the raw information is displayed. Figure 4-25 shows a radio resource containing a received call stack.

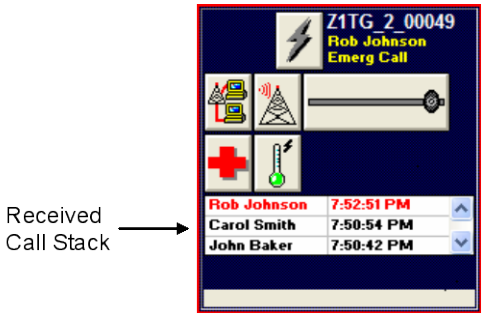


Figure 4-25: Received call stack on a radio resource

The received call stack provides a quick way for a dispatch console user to respond to calls in the stack. Various types of mouse clicks on calls in the stack provide the dispatch console user with different ways to reply to the call.

The received call stack is configurable on a per-resource per-console basis, so a resource on one dispatch console can have it while the same resource on another dispatch console does not have it.

The received call stack has a fixed memory of 25 calls, but the number of calls that are displayed is configurable via the Elite Admin application. The number displayed may be set anywhere from three to 24 calls in increments of three. Regardless of how many calls are actually displayed, the dispatch console user can always scroll through all 25 calls in the stack's memory.

Stack display size is configured on a per radio resource per dispatch console basis. That is, each resource on a dispatch console may have different sized stack displays and the same resource on different dispatch consoles may have different sized stack displays.

The dispatch console user can delete individual calls from the received call stack. All of the calls listed in a received call stack can also be deleted with a single action.

Auxiliary Input and Output Resources

Control relays and input buffers are represented as auxiliary input and output resources on the Elite Dispatch GUI. These auxiliary input and output resources are used by the dispatch console user to monitor the state of input buffers and monitor/control the state of control relays.

The auxiliary input and output resources are represented by various graphical icons that change their appearance based on the state of the resource. The particular icon that is associated with an input or output is configured by the Elite Admin application. Examples of some of the icons that may be used are shown in Figure 4-26

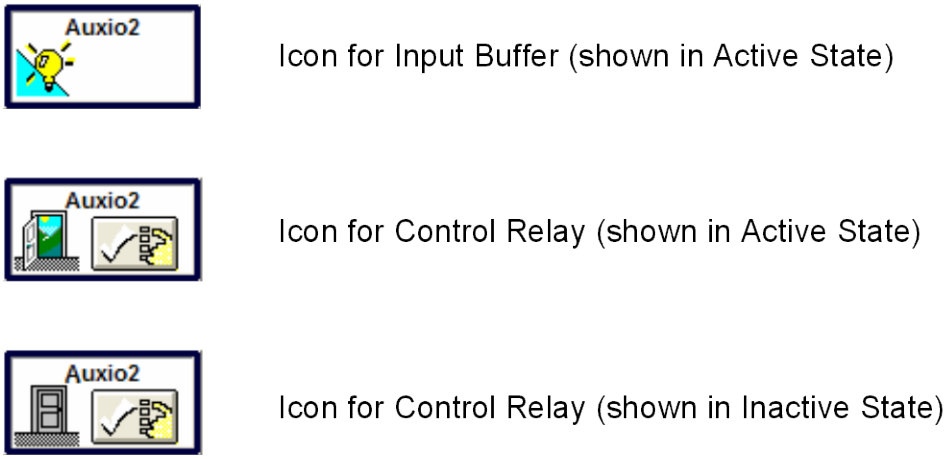


Figure 4-26: Auxiliary I/O resource icons

Auxiliary input and output resources may be grouped together so that they can be moved or assigned/de-assigned as a group. This is useful for situations where the auxiliary input output resources are being used to interface to comparators or other devices that require multiple control relays or input buffers.

Auxiliary output resources may be protected by a “safety switch” to help prevent unintended activation or deactivation. In order to activate or deactivate an auxiliary output that is protected by a safety switch, the dispatch console user must first press the safety switch and then press the auxiliary output.

Latched auxiliary input resources may also be protected by a “safety switch” to help prevent unintended clearing of an active input. In order to clear a latched auxiliary input that is protected by a safety switch, the dispatch console user must first press the safety switch and then clear the auxiliary input.

Full parallel status for auxiliary inputs and outputs is reflected across all the dispatch consoles that have the auxiliary inputs and output resources assigned on them. That is, if an auxiliary input or output changes state, the change of state is reflected on all the other dispatch consoles that have that auxiliary input or output assigned on them.

Auxiliary input and output resources may also be placed on a separate auxiliary input and output window that is capable of being hidden when not needed. A button on one of the tool bars is used to open and hide the window. This allows the dispatch console user too easily and quickly access auxiliary input and output resources that are infrequently used without permanently consuming space on the screen.

Patch and Multi-Select Folders

The patch and multi-select features are accessed via a set of dedicated folders on the Elite Dispatch GUI. These folders are smaller than the resource folders and may be placed on the screen to suit the dispatch console user's preferences. The placement is done in the Elite Admin application. There can be up to sixteen patch folders and three multi-select folders.

Patch Folders

Clicking on one of the patch folder tabs brings it into view. The patch group is then opened by clicking on the left-most button on the folder. Once the patch group is open, the patch group is editable and members may be added or removed from the patch group by clicking on the desired radio resources. Note that patch groups are active whenever there are members assigned to them. This is true even if the patch group is not open.

The members of the patch group are shown on the patch folder along with the status of each member (patched or pending). The resources in the patch also show an indication that they are in a patch group.

Some patch groups contain members that were pre-assigned by the Elite Admin application. These patch groups become active as soon as possible after the dispatch console begins using the configuration file that contains the pre-assigned patch groups. The dispatch console user can add/remove members from the pre-assigned patch group, but these additions/removals are lost when the dispatch console either re-loads the configuration file or changes to a different configuration file.

A patch transmit button is provided on the patch folder to allow the dispatch console user to easily transmit on all members of the patch group with a single button press.

Figure 4-27 shows an example of a patch folder containing some radio resources.

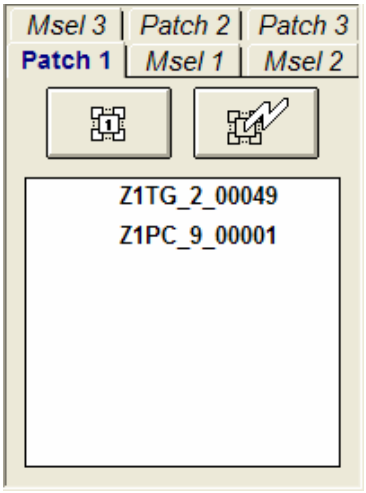


Figure 4-27: Patch folder

Multi-Select Folder

Clicking on one of the multi-select folder tabs brings it into view. The multi-select group is then opened by clicking on the left-most button on the folder. Once the multi-select group is open, the multi-select becomes active and members can be added or removed from the group by clicking on the desired radio resources. Closing the multi-select folder (by clicking on the left-most button a second time) deactivates the multi-select group.

Note that this operation is different from that of the patch folders. A dispatch console can only have one multi-select group active at a time, but it can have multiple patch groups simultaneously active.

The members of the multi-select group are shown on the multi-select folder.

Some multi-select groups contain members that were pre-assigned by the Elite Admin application. The dispatch console user can add/remove members from the pre-assigned multi-select group, but these additions/removals are lost when the dispatch console either re-loads the configuration file or changes to a different configuration file.

Figure 4-28 shows an example of a multi-select folder containing some radio resources.

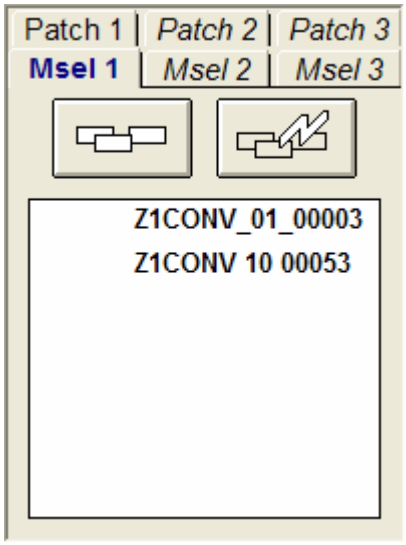


Figure 4-28: Multi-select folder

Activity Log Window

The activity log window can be used by the dispatch console user as a point of reference for all calls coming into the dispatch console. The activity log shows call information associated with all incoming radio calls such as the name of the radio resource and the time of the call. Incoming calls from all radio resources assigned to the dispatch console are displayed in the activity log.

Figure 4-29 is an example of an activity log window.

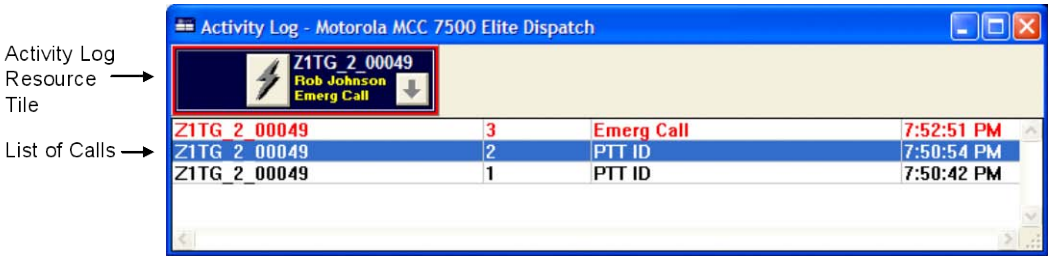


Figure 4-29: Activity log window

Up to 1,000 calls can be held in the activity log. The most recent call is on the top of the list and the oldest at the bottom. Once the list is filled, the oldest calls are discarded as new calls come in. The dispatch console user may resize the activity log to show various numbers of calls. For example, when there is light activity, the dispatch console user may choose to show only a few calls. During busy hours, the dispatch console user may view more calls by simply dragging the lower right hand corner of the activity log (making it longer) to see additional calls.

Dispatch console users may respond to incoming calls simply by clicking on a call in the list. When this is done, the entry appears highlighted and the name of the radio resource appears on the activity log resource tile at the top of the activity log. The dispatch console user can then press the instant transmit button on the activity log resource tile to communicate with that radio resource.

The information displayed by the activity log can be customized to suit the dispatch console user's needs. The activity log can be configured to show combinations of Resource Name, Unit ID or Alias, Status Number or Alias, Receiving Site ID, Receiving Zone ID and Time. This configuration is done via the Elite Admin application and, if so configured, via the dispatch console user interface.

There are two levels of control over whether or not the activity log is displayed on a dispatch console. The first level is via the Elite Admin application, which controls whether or not a dispatch console has the capability of displaying the activity log. The second level is via the dispatch console user interface where the dispatch console user can choose to view or not view the activity log. Note that if the dispatch console has not been given the capability of displaying the activity log, then the dispatch console user cannot see the activity log at all.

The number of lines that are initially displayed by the activity log is configurable via the Elite Admin application or the dispatch console user interface. The number of lines that are displayed may also be changed in real time by changing the size of the activity log window using standard Microsoft Windows resizing techniques. The user can scroll through all the entries in the activity log even if they cannot all be displayed at once.

The information listed in the activity log can be stored in a text file on the dispatch console's hard disk. The size of the text file can be specified to be between 1 MB and 20 MB. When the file fills up, new data overwrites old data beginning with the oldest data. All data associated with a call is logged to the file, regardless of what portion of the data is actually shown in the activity log window.

Help

The dispatch console is designed to allow the dispatch console user to quickly access information on how to use its features. This help is available right on the dispatch console graphical user interface.

There are three types of help available to the dispatch console user: On Line, Micro, and Tool Tips.

Online Help

Online Help provides detailed information on how to use the dispatch console. The user accesses Online Help via the Help menu on the menu bar. The user can search for topics or keywords to quickly find the desired information or the user can use a table of contents to find the information. The information is displayed in a pop-up window on the dispatch user interface.

Online Help allows new dispatch console users to shorten their learning curve and more experienced dispatch console users to quickly remember how to operate seldom-used features.

Micro Help

Micro Help provides information about the state of controls or indicators in a resource tile. When the cursor is placed over a control or indicator on a resource tile, a description of the control or indicator's state is given across the bottom of the resource tile. Figure 4-30 illustrates Micro Help text on a radio resource. The text across the bottom of the resource describes the icon to which the cursor is pointing.

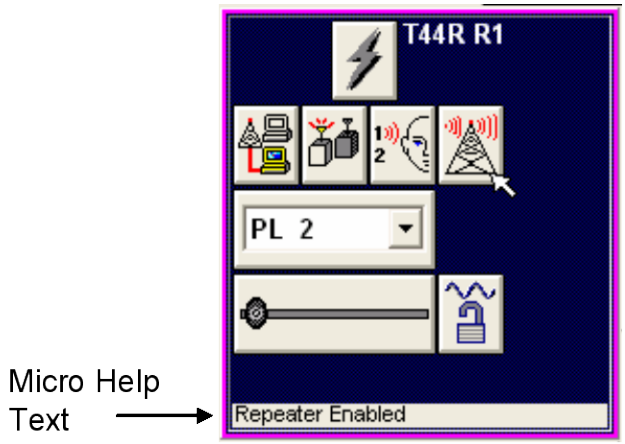


Figure 4-30: Micro Help on a radio resource

The text displayed by the Micro Help feature may be edited via the Elite Admin application.

Micro Help allows a dispatch console user to view the status of a control or indicator textually instead of graphically.

Tool Tips Help

Tool Tips Help provides information about tool bar buttons and menu bar menus to the dispatch console user. When the cursor is placed over a toolbar button, the button's name appears in a small pop-up window next to the cursor and a short explanation of the button appears in the status bar at the bottom of the dispatch user interface window. When the cursor is moved across a menu item in a menu, a description of the menu item appears in the status bar at the bottom of the dispatch user interface window.

The text displayed by the Tool Tips feature may be edited via the Elite Admin application.

Tool Tips allow a dispatch console user to see a short explanation of the button or menu item of interest quickly.

Elite Admin Application

The manner in which resources and audio are presented to the dispatch console user on the MCC 7500 dispatch console is managed by the Elite Admin application. The look and feel of the Elite Dispatch GUI, as well as how received audio is routed on the dispatch console, can be optimized to meet customers' needs.

The following sections describe how configurations for the Elite Dispatch GUI are managed and what can be configured on the dispatch console via the Elite Admin application.

Managing Dispatch Screens

When it first starts running, the Elite Dispatch GUI application reads a configuration file that tells it what should appear on the GUI and how received audio should be routed on the dispatch console. These configuration files are created by properly trained personnel using the Elite Admin application. They are often called "ELT" files because their file names have an ".elt" suffix.

Multiple ELT files may be created to address different situations. For example, different ELT files can be created for different shifts in a dispatch center if the scope of dispatching changes significantly between shifts. Alternatively, different configuration files can be created for individual dispatch console users to meet their personal preferences.

A dispatch console user may switch between ELT files during normal operations, but cannot access any resources while the original file is being closed and the new file is being opened.

The ELT files may be stored locally on the dispatch console computer, on a different dispatch console computer, or in a central location. The choice on where to store the files depends on many factors such as:

- Accessibility to the files – Do all dispatch console users need to access all the ELT files? If multiple agencies share a dispatch center, do they want to be able to access each other's files?
- Ease of managing the files – Are the dispatch consoles located in one physical location or are they geographically separated? Is one person managing the files or are multiple people managing them?
- The topology of the radio system's IP network – Are there servers (such as Domain Controllers) located at the dispatch console location that can be used to store the files? If the files are stored on a server, do the dispatch consoles have to retrieve them across WAN links?

By default, when the Elite Dispatch GUI application starts up it asks the dispatch console user to specify which ELT file it should use. If this is not the customer's preferred mode of operation, the dispatch console can be configured so that it automatically opens a particular ELT file.

Admin Capabilities

The Elite Admin application allows a properly trained user to do the following:

- Create new configurations.
- Modify existing configurations.
- Save configurations.
- Determine how many toolbars are present.
- Determine items that should go on the toolbar(s) and where on the toolbar(s) they should go.
- Determine the number of resource folders.
- Determine the number of patch/multi-select folders.
- Name the resource folders and patch/multi-select folders.
- Determine the location of patch/multi-select folders.
- Determine the height of patch/multi-select folders (e.g., taller if there are many members in the groups).
- Create pre-assigned patch/multi-select/primary groups.
- Determine if dispatch console users have the ability to assign and de-assign resources.
- Determine if the activity log is shown initially and where on the screen it is shown (dispatch console users may still hide or show the activity log).
- Assign/unassign radio and auxiliary input/output resources to various folders.
- Determine location of radio and auxiliary input/output resources in the folders (dispatch console users may temporarily change the locations by dragging and dropping the resources).
- Determine where features are placed on each radio resource.
- Modify the icons used for resource features.
- Add a safety switch on radio resources.
- Determine the size of each radio resource (compressed, larger compressed, or expanded).
- Determine whether selected radio audio stays in a speaker or moves to a headset when headsets are used (this is done on a per-resource, per-console basis).
- Determine border color for each radio resource.
- Determine audio routing of resources to speakers.
- Determine icons used for auxiliary input and outputs.
- Determine if auxiliary inputs and outputs appear in a separate window.
- Set initial volume level of each radio resource.
- Determine if auxiliary outputs are safety switch protected.
- Determine border color for each auxiliary input and output.
- Modify Tool Tips and Micro Help text.

Conventional Channel Gateway

Conventional channels are much more integrated into the trunking systems than in previous radio – console configurations. The zone controller manages conventional channels in a manner similar to how it manages trunked talkgroups. The physical interface to the analog conventional stations also changes from previous radio

systems. RF site routers are fitted with 4-wire interface cards, which are connected to the analog stations.

Doing this provides two key benefits:

- It allows the conventional audio to use the same transport network as the trunked audio.
- It reduces the number of individual interface devices in the radio system.

The portion of the router hardware and software that support the conventional stations is called the CCGW.

To interface to analog conventional stations, the routers must be able to vocode and de-vocode the conventional audio, key the station, detect when the station sends audio to the router and detect when a parallel deskset console transmits on the station. This capability has been added to the routers used in Motorola's trunking systems.

Motorola has proposed CCGW equipment to support eight (8) of the conventional stations.

Physical Interface to Station

The MCC 7500 conventional channel gateway provides four ports (per router) to which analog conventional base stations may be connected. Each port contains the following inputs and outputs.

- 600 Ohm, balanced analog audio input – Used to accept radio audio from the base station.
- 600 Ohm, balanced analog audio output – Used to send console transmit audio to the base station.
- Input buffer – Used to detect Carrier Operated Relay (COR) closure in the base station.
- 1 Amp, 24 VDC relay output – Used for relay keying of the base station.

Each port is manifested as an RJ45 connector on the router.

Supported Configurations

The MCC 7500 conventional channel gateway supports the following types of analog conventional base stations.

- R1.
- T1R1.
- T1R1 w/Paging.
- T2R2.
- T4R4.
- T8R8.
- T12R12.
- T14R14.

TnnR channels must be supported using combinations of T1R1 channels.

Auxiliary Inputs and Outputs

The MCC 7500 supports the ability to control or monitor Auxiliary inputs and outputs (Aux I/Os) that allow customers to control external devices via relay closures and sense the state of external devices via input buffers from the dispatch console. These Aux I/Os are referred to as Public Aux I/Os. Public Aux I/Os are accessible by more than one dispatch console. A change in state of the Aux I/O is reflected across all of the dispatch consoles that have it assigned on their user interfaces. These Aux I/Os are typically physically located in a common location that is shared by all the dispatch consoles.

The MCC 7500 dispatch console supports Public Aux I/Os by accessing and controlling MOSCAD RTUs and displaying the status of the RTUs' inputs and outputs on its user interface. A separate window to display the MOSCAD inputs and outputs is not required on the dispatch console.

Graphical icons provided by the dispatch console GUI are used to represent both the function and state of relay outputs. For example, an icon consisting of a light bulb may be used to represent a relay output that is controlling lighting of some type. The dispatch console user would click on the button associated with the icon to change the state of the relay output and the icon would change between a lighted bulb and an unlighted bulb to reflect the state of the lighting.

Graphical icons are also used to provide a visual indication of both the function and state of external inputs. For example, an icon consisting of a door may be used to represent an external input that is connected to a door position sensor. The door can be shown in the open state when the sensor says the door is open and it can be shown in the closed state when the sensor says it is closed.

Multiple dispatch consoles may monitor and control the same relay output and/or external inputs. In this case, state changes are indicated across all dispatch consoles simultaneously.

Individual relay outputs can be configured so that they require a safety switch to be pressed before they respond to any commands from the dispatch console user. A relay output on one dispatch console can be protected by a safety switch while the same relay output on a different dispatch console is not. The resetting of latched inputs may also be protected by using the safety switch.

Supported Aux I/O Configurations

The following Aux I/O configurations are supported.

- ***Momentary Input*** – This is an input where the user interface always shows the true state of the input. If the input is active, it is shown as active. If it is not active, it is shown as not active.
- ***Latched Input*** – This is an input where the user interface does not necessarily show the true state of the input. When the input goes active, the user interface shows the state as active. The display will continue to show the state as active even if the input changes to the inactive state. A dispatch console user must manually reset the display to return it to the inactive state. Note that a dispatch console user cannot clear the display until the input itself is in the inactive state.
- ***Momentary Output*** – This output relay is activated when the dispatch console user presses the button on the user interface and deactivated when the dispatch console user releases the button.
- ***Latched Output*** – This output relay changes state only when the dispatch console user presses the button. The release of the button has no effect on the state of the relay. One press activates the relay; the next press deactivates the relay.
- ***Interlocked Latched Output*** – This latched output relay is part of a group of latched output relays. Only one of the relays in the group may be active at a time. Pressing the button for a relay automatically deactivates the previously active relay. Pressing the same button twice does not deactivate that relay. There is always one and only one relay active in the group at all times. Interlocked relays work in a "break before make" fashion; that is, the previously active relay is deactivated before the new relay is activated.

Aux I/O Hardware

The MOSCAD SDM 3500 RTU is used to support most dispatch console Aux I/O needs. The SDM 3500 RTU is rack mountable in a standard 19-inch rack and is one rack unit high.

The SDM 3500 RTU is capable of supporting up to 16 outputs and 48 inputs. Expansion chassis can be added to increase the number of inputs and outputs. The output relays are capable of switching 1A @ 24VDC or 1A @ 24VAC. Input buffers are capable of sensing a dry closure through 1000 feet or less (round trip) of 24 AWG wire.

The RTUs can be physically located at console sites, trunking RF sites or analog conventional RF sites. The dispatch consoles and RTUs communicate with each other across the radio system's IP transport network. This allows much greater flexibility in putting Aux I/Os where they are needed compared to CENTRACOM Gold Series, which required all the Aux I/Os to be located in the CEB.

The RTU provides single pole Form A relay outputs. Double pole, Form B, or Form C relays must be implemented using external relays that are controlled by the RTU relays.

4.3.5.3 Feature Descriptions

High-level descriptions for all the features supported by the MCC 7500 dispatch console are given in this section.

Centralized System Management

The MCC 7500 console system is configured and managed by the trunking system's configuration manager, fault manager, and performance reporting applications. This provides the customer with a single point for configuring and managing the entire radio system, including the console portion.

The MCC 7500 console system is able to control certain conventional resources in addition to the trunking system. The trunking system's configuration manager, fault manager, and performance reporting applications also configure and manage the parts of the system interfacing to the conventional resources.

End-to-End Encryption

The addition of secure capability to the dispatch console allows true end-to-end encryption in the radio system. This provides the highest degree of security possible to those customers who wish to take advantage of this feature.

The dispatch consoles support multiple encryption algorithms and multiple secure keys to allow them to access and control talkgroups from different agencies, if necessary.

Gaining Access to Resources in the Communication System

Resource Assignment

Resource Assignment is a feature that allows a dispatch console user to choose which radio resources are monitored and controlled by the dispatch console. Resources must be assigned before they can be monitored and controlled. Once the assignment is made, the dispatch console starts receiving audio and status updates for the resource.

The resource assignment feature works in conjunction with the security group feature of the radio system's network manager. The security group feature determines which radio resources a given dispatch console user has the right to access. Those radio resources are then eligible to be assigned on a dispatch console via the resource assignment feature.

Resource Assignment allows the flexibility to change which resources are monitored and controlled at a dispatch console. This can be useful, for example, on shift changes. It does not force one shift to deal with resources that are only used by a different shift.

Resources can be unassigned when they are no longer needed at a dispatch console. Once resources are unassigned, the dispatch console stops receiving audio and status updates for the resource.

Aux I/O Assignment

Aux I/O Assignment is a feature that allows a dispatch console user to choose which Aux I/Os are monitored and controlled by the dispatch console. Aux I/Os must be assigned before they can be monitored and controlled. Once an Aux I/O assignment is made, the dispatch console starts receiving status updates for the Aux I/O.

Aux I/O Assignment allows the flexibility to change which Aux I/Os are assigned at a dispatch console. This can be useful, for example, on shift changes. It does not force one shift to deal with Aux I/Os that are only used by a different shift.

Aux I/Os can be unassigned when they are no longer needed at a dispatch console. Once Aux I/Os are unassigned, the dispatch console stops receiving status updates for the Aux I/O.

Resource Status

The Resource Status feature informs a dispatch console user of the operational condition of radio resources and Aux I/Os. This gives the dispatch console user greater control by knowing which resources are available and which are not available. Operational failures of the resources and Aux I/Os can be displayed to the dispatch console user so the lack of operational ability is known.

Configuration of Audio Presentation for Resources

Audio Destination Assignment

A dispatch console supports multiple speakers and can be configured so that the audio associated with different resources is routed to different speakers at the dispatch console. Audio Destination Assignment is a console feature that allows a dispatch console user to choose which audio destinations (speakers) are to be used for a given resource.

Audio for a resource is generally directed to one of two destinations, depending upon the resource's current select status. Selected resources have their audio sent to the speaker designated as the select audio destination for that resource. When a resource is not selected, its audio is sent to the speaker designated as the unselect audio destination for that resource. In most cases, a single speaker is designated as the select audio destination for all resources monitored by that console. In this case, whichever resource is currently selected has its audio presented in that speaker.

On some console installations, it may be desirable to route audio for a resource to a particular destination regardless of that resource's select status. This is accomplished by setting a resource's select audio destination to be the same as its unselect audio destination. Speakers configured in this way are often referred to as "dedicated" or "monitor" speakers.

Basic Audio (Talk/Listen) Functions

Single-Select

The Single-Select feature allows only one radio resource to be selected at a time. When a resource is single-selected, the previously selected resource becomes deselected.

The Single-Select feature is active when there are no Multi-Select groups open. When a Multi-Select group is closed without opening another Multi-Select group, the Single-Select feature becomes active, and the resource that had been selected prior to opening a Multi-Select group is once again selected.

Single-Selecting a resource routes the inbound audio on the resource to the designated speaker allowing that audio to be easily distinguishable from the other audio at the dispatch console. It automatically raises the resource's individual volume level to full so inbound audio on that resource can be heard clearly. It also designates that resource as the one to be used by console features such as General Transmit, Monitor, and Page PTT.

The main advantage of the Single-Select feature over the Multi-Select feature is that the previously selected resource is deselected when another resource is selected. This saves having to deselect one resource before selecting another.

Multi-Select

The Multi-Select feature allows a dispatch console to define groups of selected radio resources. When a Multi-Select group is opened, all of the resources in the group are simultaneously selected. A dispatch console can support multiple Multi-Select groups, each of which supports multiple, potentially overlapping, resources

If a Multi-Select group is opened while another Multi-Select group is open, the first group is closed and all of its resources deselected before the second group is opened. If a Multi-Select group is opened while no other Multi-Select group is open, the Single Selected resource is first deselected.

When a Multi-Select group is closed without opening another Multi-Select group, the Single Select feature becomes active and the resource that had been selected prior to opening the Multi-Select group is once again selected.

Resources can be added or removed from a Multi-Select group while it is open or while it is closed.

Multi-Selecting a group of resources routes the inbound audio on the resources to the resources' select audio destinations, allowing that audio to be easily distinguishable from the other audio at the dispatch console. It automatically raises the resources' individual volume level to full, so inbound audio on the resources can be heard clearly. It also designates those resources as the ones to be used by console features such as General Transmit, Monitor, and Page PTT.

The Multi-Select feature has two advantages over the Single Select feature. It allows multiple resources to be selected simultaneously. It also allows groups of resources to be defined and stored so that multiple resources can be conveniently selected and deselected. The resources of Multi-Select groups can also easily be simultaneously transmitted on without having to open the Multi-Select group by using the APB Transmit feature.

Inbound Call Indication

The Inbound Call Indication feature is used to indicate audio activity on a radio resource. If the resource is selected on the dispatch console, the indication flashes when inbound audio is detected. If it is not selected on the dispatch console, the indication does not flash. The indication is not affected by the select status of the resource on any other dispatch console.

It is also used to associate audio being heard from the dispatch console's speakers with a resource.

The Inbound Call Indication can have different sources depending on the type of resource on which it appears. For trunked resources, the source is the trunking controller. For some conventional resources, the source can be an input that detects an external dry closure. This is called a Carrier Operated Relay (COR) Input. For some conventional resources, the source is audio activity on the receive path from the station. This is called VOX detection.

Individual Resource Volume Control

The Individual Resource Volume Control feature allows the dispatch console user to change the level at which each resource is mixed into a speaker. (It is common to have the audio from many resources routed to the same speaker, especially when these resources are unselected.) The Individual Resource Volume Control feature can be used at individual dispatch consoles to lower the volume level of less important resources and raise the volume level of resources as they become important.

The initial volume level is set when the resource is assigned. The volume level for a resource is automatically raised to the full volume level when the resource is selected. If the volume level is adjusted while a resource is selected, it remains at the new volume level even after the resource is deselected. If the resource's volume level is not adjusted while the resource is selected, deselecting the resource restores its volume level to its volume level in effect prior to being selected.

All Mute

The All Mute feature is used to mute all of the audio on resources that are not currently selected at a dispatch console. When the All Mute feature is activated, all audio on resources that are not selected is muted until the All Mute feature is deactivated or a certain amount of time elapses, typically 30 seconds. The amount of time the All Mute feature stays active and the amount of attenuation it applies to the audio are programmable through the radio system's configuration application.

If a resource's individual volume setting is such that it is lower than the All Mute feature's attenuated level, the resource's volume setting will not be changed by the All Mute feature. That is, the dispatch console will not increase the resource's volume setting above the level set by the dispatch console user.

The All Mute feature is used when the dispatch console user does not want to be disturbed by the audio from the unselect resources. Using the All Mute feature is better than turning down the volume of the Unselect speaker because the volume is restored automatically when the All Mute feature is deactivated.

Acoustic Cross Mute

The Acoustic Cross Mute feature is used to prevent acoustic feedback from occurring when dispatch consoles are physically located near each other. Dispatch consoles that are monitoring the same radio resource can normally hear each other's outbound audio transmissions. This is called parallel operator audio. If two dispatch consoles are physically close to each other and the parallel operator audio appears in a speaker, the potential exists for a feedback condition between the speaker on the non-transmitting dispatch console and the microphone on the transmitting dispatch console.

The Acoustic Cross Mute feature provides the means to specify groups of dispatch consoles, which mute parallel operator audio on all radio resources that they have in common.

High Speed Mute

The High Speed Mute feature allows an external device to provide a dry contact closure to the dispatch console subsystem that, when activated, mutes the receive audio of a conventional radio resource at all dispatch consoles monitoring that resource. The audio received remains muted as long as the closure is present, and un-mutes when it is removed.

The High Speed Mute feature provides the customer with the means to control what audio appears at the dispatch consoles for a given conventional radio resource.

General Transmit

General Transmit is a feature that initiates a voice transmission on the currently selected resources. General Transmit is one of the most convenient methods for transmitting since it can be initiated with the footswitch, the headset transmit button, the microphone transmit button, or the General Transmit API functions.

General Transmit is a medium-priority transmission. Please refer to the Transmission Priority Levels feature on the following page for more information on transmit priorities.

It is important to note that a dispatch console can transfer control of an active General Transmit freely between the General Transmit API functions, the headset transmit button, the microphone transmit button and the footswitch while not losing the

transmission. This can be used to free up a dispatch console user's hands for other activities such as writing notes.

The General Transmit feature provides easy access to transmitting on the selected resources.

Instant Transmit

Instant Transmit is a feature that allows a dispatch console user to initiate a transmission on a specific resource regardless of its select state. It is the most direct method of transmitting on a resource.

Instant Transmit is a high-priority transmission. Please refer to the Transmit Priority Levels feature on the following page for more information on transmit priorities.

It is important to note that the dispatch console user can Instant Transmit even when the dispatch console user is currently performing a General Transmit or APB Transmit. In this case, microphone audio will be sent to both the selected resource(s) and the one upon which is being instantly transmitted.

The Instant Transmit feature gives the dispatch console user an additional level of control that is not available with the General Transmit feature. It gives a dispatch console user the ability to transmit quickly on a resource that is not selected. It allows a dispatch console user to monitor the audio from the selected resources in the headset, and simultaneously transmit to another resource. It also allows a dispatch console user to take over a lower-priority transmit from a parallel dispatch console.

Instant Transmit Safety Switch

Instant Transmit Safety Switch is a feature that requires a dispatch console user to press a "safety switch" before initiating an instant transmit on a specific resource (regardless of whether it is selected or not). This helps ensure the dispatcher does not accidentally instant transmit on a particular radio channel.

All Points Bulletin Transmit

All Points Bulletin (APB) Transmit is a feature that initiates a voice transmission on the resources of a Multi-Select group. An APB Transmit control on a dispatch console must have one and only one Multi-Select group associated with it.

APB Transmit is a high-priority transmission. Please refer to the Transmit Priority Levels feature in the following section for more information on transmit priorities.

The APB Transmit feature allows transmission to all resources in its associated Multi-Select group even when the group is closed.

The APB Transmit feature provides easy access for transmitting to a pre-selected group of resources. APB Transmit is commonly used to make an announcement to many radio users. It also allows a dispatch console user to take over a lower priority transmit from a parallel dispatch console.

Transmit Priority Levels

The Transmit Priority Levels feature is a hierarchy of transmit privileges for different types of transmissions on the same dispatch console or between dispatch consoles. It provides an orderly and consistent method for allowing higher priority transmissions to take over resources from lower priority transmissions.

The priority levels from highest to lowest are:

- Primary supervisor console instant transmit or APB transmit
- Secondary supervisor console instant transmit or APB transmit
- Non-supervisor console instant transmit or APB transmit
- General transmit on any type of console (single- or multi-select)
- Patch transmit on any type of console
- Console Transmits While Receiving Audio

The Console Transmits While Receiving Audio feature allows a dispatch console to receive audio from other radio resources while transmitting on a particular radio resource. This allows a dispatch console user to hear audio from other resources while transmitting.

Note that this is different from full duplex audio on a single radio resource.

Resource Transmit Status – Transmitting

The Resource Transmit Status – Transmitting feature is used on a per dispatch console basis to indicate when a dispatch console is transmitting on a resource. A visual indication is provided on the user interface to indicate it is transmitting.

Each dispatch console uses the Resource Transmit Status – Transmitting feature to display its own transmit status. It is not used to display the status of parallel dispatch consoles. Refer to the Resource Transmit Status – Parallel MCC 7500 Op Busy feature for more information about parallel dispatch console status.

Resource Transmit Status – Parallel MCC 7500 Op Busy

The Resource Transmit Status – Parallel MCC 7500 Op Busy feature is used to indicate when a parallel Motorola MCC 7500 dispatch console is transmitting on a resource. A visual indication is provided on the non-transmitting dispatch consoles to indicate a parallel dispatch console is transmitting. This feature, in conjunction with the Resource Transmit Status – Parallel Non-MCC 7500 Op Busy feature, provides the means for a dispatch console user to know if a particular resource is available for use.

The dispatch console user can see the alias of the parallel MCC 7500 dispatch console that is transmitting on either trunked or conventional resources.

Each dispatch console uses the Resource Transmit Status – Parallel MCC 7500 Op Busy feature to display the parallel console transmit status of each resource to which it has been assigned.

Resource Transmit Status – Trunking Busy/Callback

The Resource Transmit Status – Trunking Busy/Callback feature is used to indicate when a trunking resource is not available for a dispatch console user to use and to alert the user when it becomes available. Audible indications are provided on the dispatch console to indicate a trunking resource is not available and when it becomes available. This feature allows the dispatch console user to know when a trunked resource is available again without having to try to transmit on it continuously.

Trunked Base Station/Repeater Control

The Repeat Control feature (also known as Repeat Enable) allows a dispatch console user to enable and disable the ability of radio users in a talkgroup to hear the transmissions of other radio users in that talkgroup. When the feature is enabled on a talkgroup, transmit audio from a radio is made available to all of the radios monitoring the talkgroup. If the feature is disabled on a talkgroup, transmit audio from a radio is not made available to other radio users monitoring the talkgroup. In either case, the radio's transmit audio is routed to the dispatch consoles.

When repeat control is enabled or disabled, all dispatch consoles with this resource assigned are updated with the current status of the feature. This feature can be controlled from any dispatch console.

System Access Priority Select (Normal/Tactical)

The System Access Priority Select feature allows a dispatch console user to select the relative system access priority of a trunked resource within the resource's communication system. Currently, there are only two possible priorities: NORMAL priority and TACTICAL priority. Call requests from a trunked resource with TACTICAL priority have priority over call requests from a trunked resource with NORMAL priority in obtaining a repeater for communications. Only emergency calls have a higher priority than TACTICAL.

When the System Access Priority status of a resource is changed, it is updated at all dispatch consoles in the systems that are monitoring that trunked resource.

The System Access Priority Select feature can be used to change the system access priority status of a trunked resource to TACTICAL in order to give the resource a better chance of gaining communication access in a busy system. If, during a repeater busy condition, two call requests are queued with one as NORMAL and the other as TACTICAL priority, then the one with TACTICAL priority gains access to the system when the next repeater becomes available.

Supported Types of Analog Conventional Base Stations

A Motorola MCC 7500 dispatch console is capable of accessing and controlling the following types of analog conventional base stations.

- R1.
- T1R1.
- T2R2.
- T4R4.
- T8R8.
- T12R12.
- T14R14.

The above types of base stations are referred to as TnRn stations. A TnRn station has one n-frequency transmitter and one n-frequency receiver.

The dispatch console can process audio received from the station and present it to the dispatch console user via speakers or headsets key the station's transmitter and provide it with audio to be transmitted over the air (except for R1 stations which don't have a transmitter) control various features on the stations such as frequency selection, PL selection, repeater on/off, etc.

Voice Call Types on Radio Resources

Conventional PTT Call

The Conventional PTT Call feature allows a dispatch console user to initiate and receive normal PTT calls on conventional radio resources. A normal PTT call is not directed to any specific individual or talkgroup and does not carry any special importance. It is intended to be heard by all users listening to that radio resource.

Trunking Talkgroup Call

The Trunking Talkgroup Call feature allows a dispatch console user to initiate and receive talkgroup calls on trunked radio resources. A trunking talkgroup call is a method for communicating with a specific set of users on a trunked radio system. Users only hear the audio associated with talkgroups with which they are currently affiliated.

This feature allows a user to speak with a specific group of users without disturbing other users.

Trunking Announcement Group Call

The Trunking Announcement Group Call feature allows a dispatch console user to initiate and receive announcement group calls on trunked radio resources. A trunking announcement group call is a method for communicating with multiple trunking talkgroups simultaneously. An announcement group is composed of multiple talkgroups that have been grouped together. The association of talkgroups to an announcement group is done by the trunking system's configuration subsystem.

This feature allows a user to speak quickly and easily with multiple trunking talkgroups simultaneously.

Trunking Emergency Call

Trunking Emergency Calls are high-priority voice transmissions initiated by radios or dispatch consoles that allow them to communicate with each other in critical situations. Trunking emergency calls initiated by dispatch consoles reserve a voice channel for the duration of an emergency.

A trunking emergency call is initiated by a radio when the radio transmits while it is in emergency mode. Trunking emergency calls are typically presented at a dispatch console using visual indications.

Dispatch consoles are notified when another dispatch console starts a trunking emergency call.

In ASTRO 25 trunking systems, priority is given to allocating a voice channel to a trunking emergency call over a regular call regardless of whether the regular call is at either a tactical or normal priority level.

Trunking emergency calls can be initiated from a dispatch console on ASTRO 25 IP trunking resources only. When a trunking emergency call is started from a dispatch console, the call is assigned a voice channel for an indefinite period. This guarantees a path for voice communication for the duration of an emergency. The voice channel is released only when a dispatch console ends the call.

A dispatch console user can take responsibility for an emergency by recognizing the trunking emergency call. All dispatch consoles are notified that the call has been recognized.

Trunking emergency calls initiated by a dispatch console are automatically reported to all dispatch consoles as being “recognized” since a dispatch console user took an explicit action to initiate the trunking emergency call.

When an emergency is over, a dispatch console can end the trunking emergency call. All dispatch consoles are notified that the call has been ended. When a dispatch console ends a trunking emergency call, the voice channel allocated for the call is released.

Ending the trunking emergency call at the dispatch console has no effect on the state of the radio that initiated the call. Any radio units that initiated trunking emergency calls remain in emergency mode until the radio users explicitly return them to a normal mode of operation. If a radio that is in emergency mode transmits after a dispatch console user has ended the trunked emergency call, the trunked emergency call will be reestablished.

The Trunking Emergency Call feature is used by radios and consoles for high priority voice communication. A dispatch console generally initiates a Trunking Emergency Call to guarantee a voice channel for the duration of an emergency.

Received Emergency Call Indication

The Received Emergency Call Indication feature allows a dispatch console user to be quickly informed that an emergency call has been received on a trunked resource. The indication is a visual indication on the user interface.

The visual indication continues until the emergency call has been ended by a dispatch console.

The Received Emergency Call Indication feature allows the dispatch console user to quickly identify on which resource an emergency call has occurred.

Auto-Open of Quick List

The Auto-Open of Quick List feature allows a dispatch console user to quickly access the controls necessary to handle a trunking emergency call. The Quick List contains controls for recognizing an emergency call, initiating an emergency call, and ending an emergency call.

The Auto-Open of Quick List feature automatically opens the quick list when a resource with an unacknowledged emergency on the dispatch console's user interface is expanded by the dispatch console user.

The Auto-Open of Quick List feature allows the dispatch console user to begin handling an emergency with a minimum of actions.

Emergency End (Knockdown)

The Emergency End (Knockdown) feature allows a dispatch console user to terminate an emergency call. After an emergency call has been recognized and the situation has been addressed, the dispatch console user ends the emergency call by using the Emergency End feature. When the dispatch console user does this, the visual emergency indication on the dispatch console's user interface is removed, and the dispatch console informs the trunking controller and all other dispatch consoles that the emergency has been terminated. Parallel dispatch consoles then clear their own emergency status indications for the resource if no other emergencies are active on it.

Emergency Automatic Audio Level Control

The Emergency Automatic Audio Level Control feature ensures that the audio associated with an emergency call is not missed due to its volume being too low.

When an emergency call is received by a dispatch console, the volume of the received audio associated with the call is raised to its maximum level. When the emergency call is acknowledged by a dispatch console user, the volume is returned to its normal level.

The Emergency Automatic Audio Level Control feature allows the dispatch console user to hear the emergency call audible alarm is active.

Trunking Individual Call

The Trunking Individual Call feature allows a dispatch console user to initiate and receive individual calls on trunked radio resources. A trunking individual call is a method for allowing a call to be placed to a specific user on the trunking system.

A dedicated individual call resource on the dispatch console user interface allows the dispatch console user to initiate or answer an individual call. All types of individual calls are initiated from the dispatch console in the same way. When an individual call request is received by the target radio, the dispatch console user receives an indication that the target radio is ringing. At this point, the dispatch console is waiting for the radio user to “answer” the ring. Once the individual call is answered, the call is allowed to proceed.

A dispatch console user may use an individual call to communicate privately with either a single radio user or a single MCC 7500 dispatch console user.

If the target radio or dispatch console is not available when an individual call is attempted, the dispatch console user receives an indication that the call could not be completed.

All inbound individual calls are announced to the dispatch console user. A ringing inbound call must be answered explicitly by the dispatch console user.

At a dispatch console, individual calls can be ended by a request from the dispatch console or by the expiration of an audio activity timer. The audio activity timer expires when there has been no audio activity on an active individual call for an extended period. This time is specified via the configuration application at the network manager. If there is no audio activity on an active individual call for the specified amount of time, the individual call is automatically ended.

When an individual call is ended by the radio user or the other dispatch console user, the console individual call resource automatically hangs up. Similarly, when an individual call is ended by the dispatch console user, the radio or other dispatch console automatically hangs up. This is known as the Cancel Service characteristic of individual call.

The Trunking Individual Call feature is designed to allow a dispatch console to engage in private conversations with individual radio or dispatch console users. Once an individual call is established on a resource, the resource can be added to a patch group with another type of resource.

Semi-Duplex or Full-Duplex Operation

Depending on the type of radio unit and the type of trunking system, an individual call can be either semi-duplex or full-duplex. The console subsystem is capable of supporting both types of calls with no configuration changes or dispatch console user intervention required.

When a dispatch console user is involved in either type of individual call, the dispatch console user is required to activate a PTT to talk. This is required to prevent

unexpected results if a telephone resource is off-hook while an individual call is in process. A telephone resource does not require a PTT because it has hands-free full-duplex operation when the dispatch console user is using a headset. If the individual call also had hands-free full-duplex operation, the dispatch console would not be able to tell to which destination (telephone resource or individual call) the microphone audio should be sent. Therefore, a PTT is required to indicate to the dispatch console that the dispatch console user desires to speak on the individual call instead of the telephone resource. (In this context, the term “telephone resource” refers to two different types of telephone services. It refers to the external telephone that can be connected to a dispatch console so the dispatch console’s headset can be used for both radio and telephone communications. It also refers to the console telephony interface, which will be added in a future release.)

The dispatch console always allows receive audio to be presented to the dispatch console user, but in a semi-duplex call, the radio system does not provide the receive audio while the dispatch console user is transmitting.

Advanced Signaling on Trunked Radio Resources

Display Radio’s Unit ID

The Display Radio’s Unit ID feature allows a dispatch console to display the unit ID associated with an inbound radio call. Unit IDs are unique numbers assigned to each radio and dispatch console in certain types of radio systems. A radio can send its unit ID when it makes a call.

The dispatch console user interface can be configured to display the unit ID of the source radio on inbound calls. This configuration is done at the local administration application. The unit ID can appear in a Received Call Stack, the Three Line Display, the Resource Header, and the Activity Log window. Note that if an alias for the unit ID is available, the dispatch console will display the alias instead of the unit ID.

The unit ID of a parallel dispatch console is also displayed on the dispatch console when the parallel dispatch console transmits on radio resources which are common to both consoles or when the parallel dispatch console places a call to the dispatch console.

If an inbound call is received on a radio resource that does not support the concept of unit IDs, no unit ID is displayed on the dispatch console even if it has been configured to display unit IDs.

Send Console’s Unit ID

The Send Console’s Unit ID feature allows a dispatch console to send its unit ID when it transmits on a radio resource. Unit IDs are unique numbers assigned to each radio and dispatch console in certain types of radio systems. The unit ID allows the radios to display the ID of the dispatch console that is the source of the transmission.

The dispatch console's unit ID is sent when the dispatch console user transmits on a radio resource and when the user initiates an individual call to another dispatch console.

ID Conservation

The ID Conservation feature prevents dispatch consoles from consuming an inordinate amount of unit IDs in a trunked radio system. The ID Conservation feature allows a dispatch console to use a single unit ID for all the trunking talkgroup resources and individual call resources that it controls.

Emergency Alarm

An Emergency Alarm is sent by radio users to alert dispatch console users of a critical situation needing immediate attention.

When an Emergency Alarm is received by a dispatch console, an audible indication is sounded. A visual indication is also displayed to direct a dispatch console user's attention to the specific resource with the emergency alarm active on the dispatch console.

Any dispatch console user can take responsibility for an emergency by Recognizing the Emergency Alarm. All dispatch consoles are notified that the Emergency Alarm has been recognized.

The audible emergency indications are typically ended once all Emergency Alarms at a dispatch console are recognized. The audible emergency indications may also be ended by the dispatch console user without recognizing the Emergency Alarm.

When an emergency is over, a dispatch console can end the Emergency Alarm. All dispatch consoles are notified that the Emergency Alarm has been ended.

The emergency mode persists on the initiating radio unit until it is ended by the radio user explicitly.

The Emergency Alarm feature is used by radios to alert dispatch consoles of an emergency without the use of voice communication. This is generally followed by a voice transmission.

Received Emergency Alarm Indications

The Received Emergency Alarm Indications feature allows a dispatch console user to be quickly informed that an emergency alarm has been received on a trunked resource. The indications are audible and visual in nature.

The audible indication continues until either a dispatch console has recognized the emergency alarm or the dispatch console user mutes it. The visual indication continues until the emergency alarm has been ended by a dispatch console.

The Received Emergency Alarm Indications feature allows the dispatch console user to be quickly alerted that an emergency alarm has been received and to identify quickly on which resource it occurred.

Emergency Recognize

The Emergency Recognize feature allows a dispatch console user to assume responsibility for an emergency call or emergency alarm. When a dispatch console user recognizes an emergency, all other dispatch consoles are notified that the emergency has been recognized.

When an emergency has been recognized, the audible indications for that emergency are silenced at all dispatch consoles monitoring the emergency.

The Emergency Recognize feature is often confused with the Acknowledge feature. Recognize is used when a dispatch console user takes a specific action to assume responsibility for an emergency. Acknowledge is used when a piece of equipment (trunking controller or dispatch console) automatically sends a message to a radio telling it that its emergency message was received.

Mute Tones at Single Op

The Mute Tones at Single Op feature allows a dispatch console user to mute the tones associated with an emergency alarm only at his/her dispatch console. This feature does not recognize the emergency alarm, so other dispatch consoles continue to generate the emergency tones.

The Mute Tones at Single Op feature is used to silence the emergency alarm tones without recognizing the emergency. This would be used in a situation where one agency is monitoring a channel that belongs to another agency. If an emergency alarm comes in on the second agency's channel, the first agency could mute the tones at their dispatch consoles without having to wait for the second agency to recognize it.

Emergency End (Knockdown)

The Emergency End feature allows a dispatch console user to terminate an emergency alarm. All dispatch consoles are notified that the emergency alarm has been ended and which dispatch console ended it.

Call Alert

The Call Alert feature lets a dispatch console or radio leave a "page" at an unattended radio or dispatch console. Upon returning to the radio or dispatch console, the called user knows who called. Additionally, a Call Alert can be used to trigger an activity. For instance, a Call Alert may cause a vehicle's horn to sound and its lights to flash.

Typically, the "page" appears at a radio as a series of beeps along with the unit ID of the sender. Traditionally, at a dispatch console, the received "page" is presented as a series of beeps along with a visual indication of who sent the Call Alert.

When a Call Alert is sent to an individual radio or dispatch console, the receiving radio or dispatch console is expected to acknowledge it automatically. A sent Call Alert can be aborted by the initiator before an acknowledgment is received. If after a

period an acknowledgment is not received, the Call Alert is automatically terminated and the sender is notified that it was not successful.

The Call Alert feature provides the ability for a dispatch console or radio user to contact someone who is away from their radio or dispatch console, and hence cannot hear a voice message. Call Alert eliminates the need to tie up airtime trying to reach an unattended radio.

If a dispatch console receives a Call Alert, the identity of the caller can be displayed as a numeric Unit ID, or an alphanumeric alias for the calling radio.

Secure Trunked Radio Communication Functionality

Secure Capability in the Dispatch Console

The Secure Capability in the Dispatch Console feature allows radio voice messages to be encrypted and decrypted in the dispatch console itself. This feature allows the radio voice messages to be encrypted the entire time they are being transported between the dispatch console and the radio.

The dispatch console is capable of supporting up to four different encryption algorithms simultaneously. This allows dispatch console users to talk and listen on radio resources that have different encryption algorithms without any manual intervention or delay.

Trunked radio resources (talkgroups and private calls) can be configured with the ability to work in the secure mode. Secure-capable resources on a dispatch console may be configured so they always operate in secure mode or so the user can manually change between secure and non-secure modes.

The Secure Capability in the Dispatch Console feature allows conversations between a dispatch console user and a radio user to remain encrypted during the entire journey between the two users.

Advanced Encryption Standard (AES) Algorithm

The AES Algorithm feature allows the dispatch console and archiving interface server to process radio voice messages using the AES encryption algorithm. AES is a United States government encryption/decryption standard defined in Federal Information Processing Standard 197 (FIPS-197).

The dispatch console can encrypt and decrypt voice using the AES algorithm.

Secure Transmit Mode Selection

The Secure Transmit Mode Selection feature allows the dispatch console user to control the secure mode of transmissions on a trunked resource. The dispatch console user can choose whether his/her transmissions on a particular trunked resource are encrypted.

This feature applies to trunked resources individually; that is, different trunked resources on a dispatch console are independently configured to have or not have this feature. This feature can be configured differently for the same trunked resource on different dispatch consoles; that is, a trunked resource may have this feature on one dispatch console but not on another dispatch console.

When set to the secure mode, all transmissions on that trunked resource from that dispatch console are encrypted. When set to non-secure mode, no transmissions on that trunked resource from that dispatch console are encrypted.

This feature only applies to the dispatch console on which it is located. Radios and other dispatch consoles can have their secure modes set differently.

Receive Cross-Mode Indication

The Receive Cross-Mode Indication feature is used to indicate when an inbound (to the dispatch console) radio call is in a different secure mode than the dispatch console's setting for outbound (from the dispatch console) transmissions on a trunked resource. This helps prevent dispatch console users from responding to an inbound call in the wrong mode.

Clear Audio Alert

The Clear Audio Alert feature provides visual and audible indications when a trunked radio call is in the clear mode. The dispatch console can be configured to provide the indications on dispatch console transmissions, on radio transmissions received at the dispatch console or both. This alerts the dispatch console user that a call is unencrypted.

Multi-Select Cross-Mode Alert

The Multi-Select Cross-Mode Alert feature is used to inform a dispatch console user that there are trunked resources with different secure modes in a multi-select group. This helps prevent dispatch console users from transmitting the same audio in both secure and non-secure modes.

This feature does not prevent the dispatch console user from having trunked resources with different secure modes in a multi-select group; it merely informs the user that this is the case.

Patch Cross-Mode Alert

The Patch Cross-Mode Alert feature is used to inform a dispatch console user that there are trunked resources with different secure modes in a patch group. This helps prevent the transmission of encrypted audio in an unencrypted state in a patch.

This feature does not prevent the dispatch console user from having trunked resources with different secure modes in a patch group; it merely informs the user that this is the case.

Key Fail Indication

The Key Fail Indication feature is used to indicate when the dispatch console is unable to decrypt or encrypt a trunked radio voice message due to a problem with an encryption key. This indication is provided on the Elite Dispatch GUI status bar. Reasons for a key failure include a missing key or no keys match the key used to encode the incoming voice message.

Panic Key Zeroizing

The Panic Key Zeroizing feature allows all the encryption keys in a dispatch console to be erased (zeroized) with the push of a button. The button is recessed in a panel to reduce the chance of accidentally pressing it.

Erasing the keys on one dispatch console has no effect on the keys at other dispatch consoles.

Keyset/Indexset Selection via GUI

The Keyset/Indexset Selection via GUI feature allows the dispatch console user to manually select the Keyset/Indexset used by the dispatch console. This allows the dispatch console user to transmit to radios that are using a different keyset. (The dispatch console will automatically use the appropriate keyset to decrypt audio being received from a radio, so the Keyset/Indexset Selection feature does not really have an effect on received audio.)

The control for doing this is incorporated into the dispatch console's GUI so no extra devices [such as a Key Variable Loader (KVL)] are required to change which Keyset/Indexset is being used.

This feature does not apply to the archiving interface server since it does not have a GUI and it does not transmit encrypted audio.

Key Management via KVL

The Key Management via KVL feature provides the ability to manage all the keys for a dispatch console or archiving interface server using only a KVL (key variable loader).

Crosspatch Functionality

Standard Patch

The Standard Patch feature allows a dispatch console user to set up a communication path between two or more resources that are normally unable to communicate with each other. These could be trunked resources and/or conventional resources. When a dispatch console detects call activity on one resource in a patch group, it automatically transmits that audio to all other resources in the patch group.

Resources are patched by being included in a console patch group. A dispatch console supports a maximum of 16 patch groups. A resource can be a member of only one patch group in the entire console system at a time.

The Standard Patch feature can be used to allow radios within the same or different radio systems to communicate even though they use different resources in that system. For example, it can allow members of different talkgroups in a trunking system to communicate or it can allow conventional radio users to be able to communicate with other conventional radio user and/or with trunked radio users.

Patch Auto-Start

The Patch Auto-Start feature allows a dispatch console to automatically start up pre-determined patches after a power cycle or reboot on the dispatch console computer.

If a dispatch console experiences an operating system reboot or an interruption in its AC power, this feature causes the dispatch console to automatically start the dispatch application, log into the dispatch console, and start up patches for all the patch groups that have been configured to use the Patch Auto-Start feature.

Patch groups that are configured to use this feature need to be pre-configured with the radio resources that are members of the patch group. A dispatch console user may add/delete members to/from the patch group during real time operation, but if a reboot or power cycle occurs, only the pre-configured members are included when the patch is restored.

If a dispatch console user manually logs out of the dispatch application, this feature does not try to automatically restart it. It waits until the operating system is rebooted or the power is cycled off and on.

The combination of the Patch Auto-Start and the Patch Auto-Restore After Resource Interruption features provides a highly resilient patch service that may be used for long-term patch applications.

Patch Auto-Restore After Resource Interruption

The Patch Auto-Restore After Resource Interruption feature allows the dispatch console to provide as much patch functionality as possible during and after service interruptions in the radio system.

If a service interruption occurs on a resource that is in a patch group, the dispatch console keeps the patch active with the remaining members of the patch group. The interrupted resource is shown as being in a patch pending state for the duration of the interruption. If the interrupted resource is restored to service while the patch group is still active, the dispatch console attempts to add the resource back into the patch.

If a service interruption occurs that affects all the resources in a patch group, the dispatch console keeps the patch active with no members in it. Resources are shown as being in a patch pending state for the duration of the interruption. If resources are restored to service while the patch group is still active, the dispatch console attempts to add the resources back into the patch.

The word “attempts” is used in the previous paragraphs because there are conditions outside the control of the dispatch console, which may prevent it from adding a resource to a patch. Examples of these include the resource may not be available for use or another dispatch console placed it in a patch first.

The Patch Auto-Restore After Resource Interruption feature allows the dispatch console to provide as much patch functionality as possible after service interruptions without human intervention. This is useful for patches that are desired to be active for long periods.

The combination of the Patch Auto-Restore After Resource Interruption and the Patch Auto-Start features provides a highly resilient patch service that may be used for long-term patch applications.

Permanent Patch

The Permanent Patch feature has been replaced by a combination of the Standard Patch, the Patch Auto-Start and the Patch Auto-Restore After Resource Interruption features. Please refer to those features for information about what they do.

Patch Transmit

Patch Transmit is a console feature that allows a dispatch console to initiate a transmission on all resources contained within a patch group.

Patch transmit is considered a low priority transmission; its priority is less than that of all other transmit functions. A dispatch console using a higher priority transmission can take control of a resource from another dispatch console using a lower priority transmission. Note that this does not mean the higher priority transmission becomes the audio source for the patch. It only becomes the audio source for the channel(s) upon which it is transmitting.

A dispatch console can only patch transmit to one patch group at a time.

Note that if a dispatch console user does any type of transmission on a member of a patch group, the dispatch console will automatically transmit on all the other members of the patch group as well. While this operation does not involve the patch transmit feature, it does provide similar results.

The patch transmit feature allows a dispatch console user to send a voice transmission to all members of a patch group. This can be a convenient way for a dispatch console user to inform members of a patch group when a patch has been established between resources, or when the patch group is about to be dissolved.

Patch Busy Indication

The Patch Busy Indication feature provides a dispatch console user with an indication that a resource is a member of an active patch group on any dispatch console in the radio system. This is important because a resource can only be a member of one active patch group at a time.

Patch Reserved Indication

The Patch Reserved Indication feature provides a dispatch console user with an indication that a resource is a member of an active patch group on his/her dispatch console. This is important because a resource can only be a member of one active patch group at a time.

Patch Pending Indication

The Patch Pending Indication feature provides a dispatch console user with an indication that a resource the user is trying to place into a patch is not available. Some reasons a resource may not be available include:

- It is already a member of an active patch group on another dispatch console in the radio system
- It may not be affiliated with the trunking system's controller
- A hardware failure may be rendering it unavailable

The dispatch console will continue to monitor the status of the resource and will attempt to include it in the patch if it becomes available.

Patching Op Indication

The Patching Op Indication feature allows the dispatch console user to see which dispatch console patched a resource. This is useful in control rooms with many dispatch consoles and a user wants to quickly find out which dispatch console is controlling a patch.

Pausing the cursor on the Patch Busy Indication on a radio resource shows which dispatch console set up the patch group.

Communication System Request Rejections

Resource Reject

The Resource Reject feature informs the dispatch console when a requested operation, such as General Transmit, Instant Transmit, Call Alert, etc., has been rejected by the radio system. This feature provides information regarding the reason the request has been rejected by the radio system for the affected resources. Resource Reject messages differ from error messages in that a *reject* comes from the radio system whereas an *error* is generated within the dispatch console.

In certain situations, a single request might result in reject messages being received for multiple resources. For example, multiple rejects might be the result of resource regrouping done by a trunked radio system.

Resource Rejects are directed to the dispatch console that attempted the rejected operation. Parallel dispatch consoles do not receive the rejects.

Resource Rejects provide dispatch console information as to why the radio system is not allowing an attempted action to be performed. In many cases, the reject is because of a temporary condition within the system (e.g., all resources are busy, or

the target radio is involved in another operation) which does not necessarily require corrective action. In other situations, a Resource Reject message informs the dispatch console of a system problem, indicating the need for a “system administrator” to correct the problem in the radio system. When an action is rejected, the Resource Reject feature provides a specific reason for why the request was denied.

Announcement/Intercom Functionality

Selective Op Intercom via Individual Call

The Selective Op Intercom via Individual Call feature allows a dispatch console user to speak privately with another dispatch console user through the dispatch consoles.

This feature is based on the Trunking Individual Call feature that allows a dispatch console user and a radio user to engage in a private conversation.

The user interface and operation of the Selective Op Intercom via Individual Call feature are the same as for the Trunking Individual Call feature. Please refer to the description text for the Trunking Individual Call feature for more information.

The Selective Op Intercom via Individual Call feature allows two dispatch console users to speak privately with each other through their dispatch consoles. It is useful for situations where two dispatch console users need to talk with each other, but are not close enough to talk face to face.

Group Op Intercom via Talkgroup Call

The Group Op Intercom via Talkgroup Call feature allows a group of dispatch console users to speak with each other through their dispatch consoles.

This feature is based on the Trunking Talkgroup Call feature. A talkgroup containing only dispatch consoles as members can be created. Any dispatch console transmitting on this talkgroup would be heard by all the dispatch consoles monitoring that talkgroup. Multiple talkgroups can be created to create different intercom groupings. This does not require any additional hardware beyond what is required for the rest of the trunking system.

The user interface and operation of the Group Op Intercom via Talkgroup Call feature are the same as for the Trunking Talkgroup Call feature. Please refer to the description text for that feature for more information.

The dispatch console user groupings are created by assigning trunking talkgroup to the desired dispatch consoles. All dispatch consoles that share such a resource may talk with each other. A dispatch console may be part of multiple groups.

The Group Op Intercom via Talkgroup Call feature allows a group of dispatch console users to speak with each other through their dispatch consoles. It is useful for situations where a specific group of dispatch console users need to talk with each other, but are not close enough to talk face to face.

All Op Intercom via Talkgroup Call

The All Op Intercom via Talkgroup Call feature is identical to the Group Op Intercom via Talkgroup Call feature. The only difference is the Trunking Talkgroup Call resource appears on all dispatch consoles. Thus, all dispatch consoles can participate in the discussion.

The All Op Intercom via Talkgroup Call feature allows all dispatch console users to speak with each other through their dispatch consoles. It is useful for situations where all dispatch console users need to talk with each other, but are not close enough to talk face to face.

System Maintenance and Supervisory Functions

Primary/Secondary Supervisor Levels

The Primary/Secondary Supervisor Levels feature provides a means for establishing a hierarchy of authority between the users of dispatch consoles. This hierarchy is used by the Transmit Priority Levels feature to determine the priority level of each transmission in a console subsystem.

There are three levels of dispatch consoles - primary supervisor, secondary supervisor, and non-supervisor. A primary supervisor is the highest level and has transmit priority over all secondary supervisors and non-supervisors. A secondary supervisor is the second highest level and has transmit priority over all non-supervisors. A non-supervisor console is the lowest level and has no transmit priority over any other console.

The primary and secondary supervisor designations are associated with users, not with physical dispatch consoles. A console subsystem can have multiple dispatch consoles of each level.

The Primary/Secondary Supervisor Levels feature allows supervisory personnel to have the transmit priority necessary to carry out their responsibilities in a console subsystem.

Multiple Primary Supervisors

The Multiple Primary Supervisors feature allows multiple dispatch console users to be designated as primary supervisors in the same radio system. Refer to the description text for the Primary/Secondary Supervisor Levels feature for more information about primary supervisors.

This feature is useful when multiple customers are sharing a radio system and each customer wishes to have their own primary supervisor.

Console Disable

The Console Disable feature allows a dispatch center supervisor to send a disable command from the radio system's network manager to a particular dispatch console. Once the target dispatch console receives the disable command, the dispatch console becomes inoperable. None of the console features or resources can be used, and no call activity can be initiated or received on the disabled dispatch console. In addition, all the current activity on the dispatch console is ended. For example, if there is any kind of transmission active on the dispatch console, the transmission is aborted. If resources are patched by this dispatch console, the resources are removed from the patch group.

A dispatch center supervisor can send an enable command from the radio system's network manager to a previously disabled dispatch console in order to make it operable.

The Console Disable feature can be used to disable a dispatch console that is not being used in order to prevent unauthorized personnel from misusing it. For example, if a dispatch console is located in a remote site and is not being supervised, the dispatch console can be disabled.

Supervisor Takeover

The Supervisor Takeover feature allows a supervisor in a dispatch room to control whether or not a non-MCC 7500 dispatch console (e.g., a deskset) can access an analog conventional base station that is controlled by an MCC 7500 dispatch console. A relay is used to physically disconnect the transmit wireline pair from the non-MCC 7500 dispatch console from the station.

This feature can be used while the non-MCC 7500 dispatch console is actively transmitting on the channel. This has the effect of immediately de-keying the transmitter. The feature may be configured so the parallel non-MCC 7500 dispatch console is still able to hear any audio being received by the base station from radios.

This feature allows a supervisor to prevent unauthorized individuals from using parallel non-MCC 7500 dispatch consoles to transmit on conventional stations.

Aliasing

In a console dispatch environment, it is desirable for users to have the ability to use familiar names in place of various numbers that are used in radio systems. Names can be recognized quickly and are easier to remember than numbers.

An alias is an alphanumeric text string that is associated with some element of a console subsystem (e.g., a conventional channel, a talkgroup, a user, a "button" on a user interface, etc.). Typically, aliases are defined by users during the configuration of the console subsystem and do not change very often.

Aliases are used in the configuration, operation, and management of the console subsystem.

Trunking Talkgroup Resource

A Trunking Talkgroup Resource is capable of having a single 16-character alias associated with it. The aliasing system is capable of providing an alias for each Trunking Talkgroup Resource in the radio system.

The Alias feature allows dispatch console users to identify Trunking Talkgroup Resources by names rather than numbers. This allows dispatch console users to easily and efficiently operate the dispatch console.

Trunking Announcement Group Resource

A Trunking Announcement Group Resource is capable of having a 16-character alias associated with it. The aliasing system is capable of providing an alias for each Trunking Announcement Group Resource in the radio system.

The Alias feature allows dispatch console users to identify Trunking Announcement Group Resources by names rather than numbers. This allows dispatch console users to easily and efficiently operate the dispatch console.

Trunking Individual Call Resource

A Trunking Individual Call Resource is capable of having a 16-character alias associated with it. The aliasing system is capable of providing an alias for each Trunking Individual Call Resource in the radio system.

The Alias feature allows dispatch console users to identify Trunking Individual Call Resources by names rather than numbers. This allows dispatch console users to easily and efficiently operate the dispatch console.

Conventional Channel Resource

A Conventional Channel Resource is capable of having a 16-character alias associated with it. The aliasing system is capable of providing an alias for each Conventional Channel Resource in the radio system.

The Alias feature allows dispatch console users to identify Conventional Channel Resources by names rather than numbers. This allows dispatch console users to easily and efficiently operate the dispatch console.

Conventional Channel Frequency Selection Control

A Conventional Channel Frequency Selection Control is capable of having multiple 16 character aliases associated with it. Each frequency can have a unique alias within the control. The aliasing system is capable of providing an alias for each Conventional Channel Frequency Selection Control in the radio system.

The Alias feature allows dispatch console users to identify frequencies by names rather than numbers. This allows dispatch console users to easily and efficiently operate the dispatch console.

Conventional Channel PL Selection Control

A Conventional Channel PL Selection Control is capable of having multiple 16-character aliases associated with it. Each PL code can have a unique alias within the control. The aliasing system is capable of providing an alias for each Conventional Channel PL Selection Control in the radio system.

The Alias feature allows dispatch console users to identify PL codes by names rather than numbers. This allows dispatch console users to easily and efficiently operate the dispatch console.

Unit ID

A Unit ID is capable of having a 16-character alias associated with it. The aliasing system is capable of providing an alias for each Unit ID in the radio system.

The Alias feature allows dispatch console users to identify Units by names rather than numbers. This allows dispatch console users to easily and efficiently operate the dispatch consoles.

Aux I/O Resource

An Aux I/O Resource is capable of having a 16-character alias associated with it. The aliasing system is capable of providing an alias for each Aux I/O Resource in the radio system.

The Alias feature allows dispatch console users to identify Aux I/O Resource by names rather than numbers. This allows dispatch console users to easily and efficiently operate the dispatch consoles.

Security Management

User Accounts and Passwords

Radio system user accounts are used in radio systems to provide access to resources, simplify the use of certain features, and assist in ensuring security. The radio system allows an administrative user to create accounts for the various users of the system and assign different capabilities and access rights to them. One such account is for the users of the console subsystem.

A dispatch console requires that a valid radio system user account name and password be entered before it can be used on the radio system. The dispatch console validates the user account name and password with the radio system's network manager and allows the user to access only the resources for which the user has access rights. This also applies to third party applications that use the dispatch console's API.

Note that these radio system user account names and passwords are in addition to any user account names and passwords required to log into the Windows operating system on the dispatch console PCs.

Agency Partitioning

The radio system provides users with the ability to create groups of users and assign system resource access rights to those groups. This allows users to control which users have access to which resources in the radio system. This is how agency partitioning is supported in the radio system.

Agency partitioning allows radio systems, which are used by multiple agencies, to be configured in such a way that the users from each agency only have access to their agency's resources. This helps keep an agency's resources available for its users, and it prevents unauthorized people from making any changes to the agency's resources.

The console subsystem participates in this agency-partitioning scheme. Access to the various parts of the console subsystem is managed by the access rights given to user accounts.

A dispatch console checks with the network manager for the access rights assigned to the user and allows access to only the resources for which the user has access rights. This also applies to third party applications that use the dispatch console API.

The radio system network manager checks the access rights assigned to the user wishing to configure the console subsystem and allows access to only the portions of the console subsystem for which the user has access rights.

Network Security Enhancements

The radio system's IP transport network is protected against viruses, hackers and other unauthorized activities by a set of enhancements that are applied to each product connected to the network. The dispatch consoles support these enhancements.

Fault Management

Hardware Element Monitoring

The radio system's fault manager monitors and reports the status of all the hardware elements in the console subsystem. This allows the console subsystem to be fault managed from the same point at which the rest of the radio system is fault managed.

The specific hardware elements that are monitored are the dispatch console and any networking equipment that supports the console elements. Each of these hardware elements monitors critical internal hardware sub-elements and reports their status. This allows a failure within a hardware element to be detected. The hardware elements in the console subsystem are also periodically polled to request their status. This allows a failure of an entire hardware element to be detected.

Software Process Monitoring

The console subsystem monitors and reports the status of all the critical software processes running on the various hardware elements that comprise the subsystem. Changes in the status of software processes on a device are recorded internally. These

internal records are primarily intended for use by qualified technical personnel in troubleshooting problems with the console subsystem. Status changes, which are useful for understanding the console subsystem's overall status, are also reported to the radio system's fault manager.

If a failure of a software process is detected, self-healing actions may be initiated to correct the failed process. Refer to the Self-Healing Actions feature for more information.

Network Link Integrity Monitoring

The network elements, which are used by the console subsystem, are monitored in the same manner as the network elements for the rest of the radio system. Any failures in these links are reported to the radio system's fault manager.

Automatic Discovery of Console Elements

The console subsystem supports the automatic discovery of console elements by the radio system's fault manager. This saves the user from having to manually gather and enter the necessary data into the radio system fault manager.

The radio system fault manager automatically discovers all network elements (both Motorola-manufactured elements and Motorola-supported third party elements) that are included in the system and adds them to the map of network elements in a topologically descriptive manner.

Outputting of Monitoring Results (SNMP)

The console subsystem supports the reporting of fault status to the radio system's network manager via the SNMP protocol.

Self-Healing Actions

The console subsystem automatically takes certain actions to try to remedy failures detected by its fault management routines. These actions are intended to provide as much functionality to the user as possible.

These actions include restarting failed software processes, resetting internal hardware or reloading software into internal hardware.

Configuration Management

Configuration Application

The console subsystem is configured by an application residing on the radio system's network manager. This configuration application is used to configure all console subsystem elements in the radio system. Using the configuration application, the user defines what hardware is present at each element and the capabilities of each element.

This configuration application is used in conjunction with the Elite Admin application.

The configuration application is used to define what is potentially available at each console subsystem element.

The Elite Admin application is used to define exactly which resources are available to the dispatch console user and how they are presented to the dispatch console user.

Automatic Distribution of Configuration Changes

When a change is made to the configuration information for the console subsystem, the radio system's network manager automatically distributes the changed information to all the console subsystem elements that require it.

As-Configured Documentation

The configuration management system generates documentation that allows the user to verify the configuration that was entered and provide information necessary for installation of the console subsystem.

The following information is contained in the documentation generated by the configuration management system:

- Console subsystem information – A listing of which dispatch consoles have been created in the console subsystem
- Dispatch console information – A listing of the peripherals, peripheral port assignments, capabilities and audio destination assignments for each dispatch console
- Conventional channel gateway information – A listing of the channels, channel capabilities, channel connection information, and main/alternate designation for each conventional channel gateway
- Trunked resource information – A listing of the type of and capabilities for each trunked resource controlled by the console subsystem
- Conventional resource information – A listing of the type of and capabilities for each conventional resource in the console subsystem
- Aux I/O information – A listing of the type of capabilities for each auxiliary input or output in the console subsystem

Date and Time

Date and Time Synchronization

The console subsystem synchronizes its time and date information with the radio system's time source via Network Time Protocol (NTP) on the radio system's IP network. This ensures that the time displays at the dispatch consoles and any time stamps on events in log files are accurate.

Adjustments for 12/24 hour format, different time zones, and Daylight Savings Time are automatically made if the operating system on the dispatch consoles and other console subsystem elements is configured to support them.

Time Display

The dispatch console provides the user with the ability to display the current time on the user interface. The time is synchronized with the radio system's time source.

The time displayed on the user interface is the PC clock time. Adjustments for 12/24 hour format, different time zones, and Daylight Savings Time are automatically made if the operating system on the dispatch consoles is configured to support them.

4.3.5.4 MCC 7500 Dispatch Console Components

To take full advantage of all the capabilities of the ASTRO 25 trunked digital voice system, and to support the wide variety of dispatch needs, Motorola offers the MCC 7500 IP console system. The MCC 7500 console subsystem is tightly integrated to the ASTRO 25 digital voice system. The MCC 7500 is our ASTRO 25 IP console, and the most advanced offering in Motorola's line of radio dispatching products. The MCC 7500 is a state-of-the-art console system that will be installed in accordance with recognized industry standards of police and fire dispatch centers. The new console system will meet public safety dispatching needs for Sumter County.

The various hardware elements that which comprise the dispatch console are illustrated in Figure 4-31 and described in the following sections.

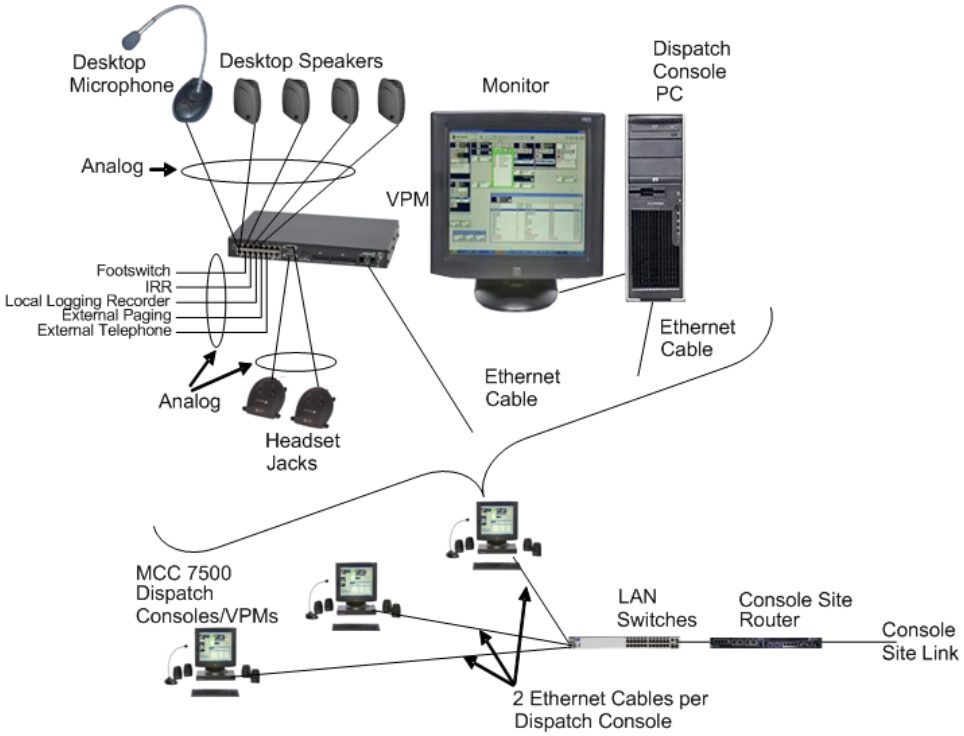


Figure 4-31: MCC 7500 IP console system

4.3.5.4.1 Personal Computer

The dispatch console uses a customized Motorola-certified PC running the Microsoft Windows 7 operating system. The PCs used in ASTRO 25 systems have a mini-tower form factor.

4.3.5.4.2 Voice Processor Module

The Voice Processor Module (VPM) is a device that combines the functions of a voice card, encryption card, and a general-purpose input/output module in a MCC 7500 console subsystem. The VPM provides the necessary interfaces to connect analog devices to the MCC 7500 digital console and it is responsible for audio routing between the dispatch operator, peripherals, and the local network. It contains both digital and analog (audio) circuits to support secure and clear voice processing.

The VPM connects to the console site LAN switch and communicates with the dispatch console PC via Ethernet. There is a one-to-one relationship between the VPM and the PC. Each dispatch position has its own PC and its own VPM. The VPM provides all the audio processing services and encryption/decryption services for the VPM-based dispatch console. These include:

- Vocoding services – Capable of supporting AMBE and IMBE (for ASTRO 25), ACELP (for Dimetra IP) and G.728 (for analog resources) vocoder algorithms
- Audio processing services – Capable of supporting audio level adjustments, summing and filtering and multiple simultaneous streams of audio
- Encryption and decryption services – Capable of supporting multiple simultaneous encryption/decryption sessions using multiple algorithms and multiple secure keys

The VPM provides the connections for the following items.

- Speakers.
- Headset Jacks.
- Microphone.
- Footswitch.
- Headset.
- Instant Recall Recorder for Radio.

The connections for the above items use RJ45 connectors except for the headset jack connectors, which are DB15. The audio inputs and outputs are 600 Ohm, balanced and transformer coupled, except for the microphone, which is 2000 Ohm, balanced, and does not use a transformer. They accept or provide audio levels appropriate for the devices being connected.

The VPM-based dispatch console provides a suite of application programming interfaces (API) that may be used by third parties to interface computer aided dispatch (CAD) systems, non-Motorola dispatch consoles, or other devices with the Motorola radio system.

4.3.5.4.3 Desktop Gooseneck Microphone

The dispatch console is capable of supporting a single desktop gooseneck microphone. The desktop microphone contains a microphone cartridge on a flexible shaft and two buttons in its base. One button controls the General Transmit feature and the other controls the Monitor feature.

4.3.5.4.4 Headset Jack

A MCC 7500 dispatch console is capable of supporting up to two headset jacks. A headset jack allows a dispatch console user to use a headset while operating the dispatch console. The headset jacks ship from the factory configured for 6-wire headsets. When a headset is plugged into a headset jack, the selected receive radio call audio is typically removed from the speaker(s) and routed to the headset earpiece. The radio resource may be configured to output receive audio through the speaker and not to the headset earpiece when a headset is in use. If two headsets are connected to a dispatch console, the same radio audio appears in the earpieces of both of them.

When an external telephone set connected to a dispatch console's external telephone port and is taken off hook while a headset is connected to a dispatch console, the selected radio audio is removed from the headset earpiece and routed to the appropriate speaker. The received telephone audio is routed to the earpiece of the headset connected to the first headset jack. The microphone of the headset connected to the first headset jack becomes live and its audio is routed to the external telephone set. This allows the dispatch console user who is using the headset connected to the first headset jack to talk and listen on the telephone set in a hands free full duplex mode. A headset connected to the second headset jack cannot be used with the external telephone set; it may only be used with the radio channels on the dispatch console.

4.3.5.4.5 Dispatch Speaker

Each speaker on a dispatch console contains unique audio; that is, an audio source cannot appear in multiple speakers at a single dispatch console. The speaker is designed for use near computer monitors or mounted on a computer monitor. It contains an amplifier that provides a maximum of two watts of power.

4.3.5.4.6 Footswitch

The footswitch allows a dispatch console user to access the General Transmit feature or Monitor feature without using his/her hands. This is useful in situations where the ASTRO 25 System Failure Mode Analysis

Motorola's ASTRO 25 trunking networks have three modes of operation for increased reliability. The normal mode of operation is Wide Area Trunking. In the event of multiple component failures that lead to system disruption, the system is equipped to continue operation in two reduced feature operational modes: Site Trunking and Failsoft.

The following pages include a detailed description of each of these operational modes, as well as a comprehensive analysis of the possible infrastructure failure scenarios and the system redundancy for mitigating each scenario.

4.3.6 Wide Area Trunking

Wide Area Trunking is the ASTRO 25 system's normal mode of operation. Wide Area Trunking implies that the Fixed Network Equipment is operating properly. All Simulcast cells and ASTRO 25 Repeater Sites are communicating with the Zone Core. Subscriber units automatically roam between the various network RF cells. Talkgroup calls occur in the appropriate RF cells if users are distributed throughout multiple cells. Data applications are properly assigned channels for communication between the subscriber units and the host application.

4.3.7 Site Trunking

Site Trunking is the first failover mode of operation. Site Trunking impacts individual RF cells within a network. In multiple RF cell systems, one RF cell can be in Site Trunking, while the rest of the system remains in Wide Area Trunking. Site Trunking implies that the Simulcast Prime Site Controller or the ASTRO 25 Repeater Site has lost connectivity with the Zone Core. Talkgroup calls initiated in the RF cell that is in Site Trunking will only be broadcast in that RF cell. Dispatch consoles use control stations or the operators use portable radios to communicate on a Site Trunking RF Cell. Console priority is not available in Site Trunking. Data applications are not available on a site in Site Trunking and will have to be reinitiated once the system reverts to Wide Area Trunking.

Radios detect if a site is in Wide Area Trunking or site trunking. Radio models with a display will indicate to the user when the site is operating in site trunking. The radio alternately displays the selected talkgroup and "Site Trunking". Depending on how the system and user equipment are programmed, subscriber units will try to roam to an RF cell that is in Wide Area Trunking.

4.3.8 Failsoft by Talkgroup

Subsystem/Site Failsoft is the final fallback means of communication if a site no longer maintains Wide Area or Site Trunking operation. Multiple failures have to occur for the system to enter Failsoft. Failsoft impacts individual RF cells within a network. In multiple RF cell systems, one RF cell can be in Failsoft, while the rest of the system remains in Wide Area Trunking. The subsystem goes into Failsoft mode in any of these scenarios:

- The site controllers are not functioning properly
- When all control channels are disabled or malfunctioned
- When only one channel is enabled

Failsoft operation provides communications in conventional mode via repeaters/base radios in order to maintain vital communications. In an IP multisite Simulcast subsystem in subsystem-wide Failsoft, received audio is routed to the comparator for voting and redistributed to all of the sites for Simulcast transmission.

The subscriber's operation in Failsoft mode is determined by the subscriber's programming. A subscriber can be programmed to behave in the following manner:

- Failsoft by control channel operation – The subscriber first scans for alternate control channels outside the multisite subsystem, then scans the control channel frequencies for Failsoft data.
- Failsoft by working group – The subscriber looks for Failsoft data on a pre-programmed frequency after a scan for alternate control channels outside the multisite subsystem is unsuccessful. If the subscriber cannot decode Failsoft data on the pre-programmed frequency, the subscriber then scans the control channels in the Simulcast subsystem for Failsoft data.

Dispatch Consoles use control stations or the operators use portable radios to communicate on a Site Trunking RF cell. Console priority is not available in Site Trunking. Data applications are not available on a site in Failsoft and will have to be reinitiated once the system reverts to Wide Area Trunking.

4.3.9 Individual Component Failure Scenarios

Table 4-25: Failure of Zone Controller A at the Zone Core

Scenario:	Failure of Zone Controller A at the Zone Core
Result:	Motorola has provided redundant Zone Controllers at the Zone Core. Failure of the active Zone Controller at the Zone Core will result in automatic switchover to the redundant Zone Controller. As the switchover process takes place, the system will temporarily enter site trunking mode for a period less than 60 seconds. Only active calls at the time of switchover will be dropped. Wide area trunking will be restored when the switchover process is complete. Any and all calls generated after automatic switchover to the redundant controller will not observe any change of service. During the transition, the dispatch operators will revert to operating on Control Stations.
	The Zone Controllers have redundant power supplies as a standard feature, which will help keep the controllers operational in case of a failure of that component. The redundant controller is regularly updated with all pieces of critical information so that if it needs to become the active controller, the current system configuration and operational characteristics are maintained.
Protection:	Redundant Zone Controllers at the Zone Core and hot swappable spare boards for the Zone Controllers.
Detection:	Alarm on Manager Terminal.

Table 4-26: Failure of Zone Controller A and B at the Zone Core

Scenario:	Failure of Zone Controller A and B at the Zone Core.
Result:	In the unlikely event that both the active and redundant Zone Controllers fail, the system will automatically switch over to Site Trunking at all ASTRO 25 Simulcast Sites. The ASTRO 25 Trunked Simulcast sites will continue to trunk in their respective cells and coverage areas; however, there will be no direct linking of calls between the ASTRO 25 Trunked Simulcast Sites and/or Repeater Sites. Users within an RF cell will be able to operate in the trunking mode with their respective dispatch centers (using wireless connectivity via backup control stations). When the Zone Controllers come back online, the system will return to Wide Area Trunking.
Protection:	Hot swappable spare boards, Backup WAN links at each remote Simulcast site, ASTRO 25 Trunked Repeater Site, and dispatch sites.
Detection:	Alarm on Manager Terminal.

Table 4-27: Failure of a Zone Core Enterprise Switch

Scenario:	Failure of a Zone Core Ethernet Switch at the Zone Core
Result:	Motorola's ASTRO 25 system employs dual Zone Core Ethernet Switches at the Zone Core. All equipment critical for wide-area voice communications has connections to both switches. Failure of one Ethernet Switch on the active Zone Core will cause the LAN traffic to use the other switch. The entire system remains in the Simulcast Wide Area Trunking mode. The failure is transparent to all system users.
Protection:	Dual Zone Core Ethernet Switches, Spare Switch.
Detection:	Alarm on Manager Terminal.

Table 4-28: Failure of both Zone Core Enterprise Switches

Scenario:	Failure of both Zone Core Enterprise Switches at the Zone Core
Result:	In the unlikely event that both Zone Core Enterprise Switches fail at the Zone Core, the system will automatically switch over to Site Trunking at all ASTRO 25 Simulcast and Repeater Sites. The ASTRO 25 Trunked Simulcast and Repeater sites will continue to trunk in their respective cells and coverage areas; however, there will be no direct linking of calls between the ASTRO 25 Trunked Simulcast and/or Repeater Sites and dispatch centers. Users within an RF cell will be able to operate in the trunking mode with their respective dispatch centers (using wireless connectivity via control stations). When the Enterprise switches come back online, the system will return to Wide Area Trunking.
Protection:	Spare Enterprise Switch.
Detection:	Alarm on Manager Terminal.

Table 4-29: Failure of a Zone Core Router

Scenario:	Failure of a Zone Core Router at the Zone Core
Result:	The Zone Core configuration for the proposed Sumter County system consists of redundant Core Routers. The Core Routers are configured so that all RF cells and dispatch centers are connected to both Core Routers. Failure of one Core Router at the active Zone Core will result in automatic switchover to the redundant Core Router. The entire system remains in Wide Area operation. The failure is transparent to all system users.
Protection:	Redundant Core Router, Optional spare Core Router, Redundant site links.
Detection:	Alarm on Manager Terminal.

Table 4-30: Failure of Both the Main and Redundant Core Routers

Scenario:	Failure of Both the Main and Redundant Core Routers at the Zone Core
Result:	The Zone Core configuration for the proposed Sumter County system consists of two Core Routers. The Core Routers are configured so that all RF cells and dispatch centers are connected to both Core Routers. In the unlikely event that both Core Routers fail at the Zone Core, the system will automatically switch over to Site Trunking at all ASTRO 25 Simulcast and Repeater Sites. The ASTRO 25 Trunked Simulcast and Repeater sites will continue to trunk in their respective cells and coverage areas; however, there will be no direct linking of calls between the ASTRO 25 Trunked Simulcast and/or Repeater Sites and dispatch centers. Users within an RF cell will be able to operate in the trunking mode with their respective dispatch centers (using wireless connectivity via control stations). When the Core Routers come back online, the system will return to Wide Area Trunking.
Protection:	Redundant Core Router, Optional spare Core Router. Redundant Site Links.
Detection:	Alarm on Manager Terminal.

Table 4-31: Failure of the Network Management Servers

Scenario:	Failure of the Network Management Servers at the Zone Core
Result:	There are several Network Management servers on the ASTRO 25 Network LAN. The failure of any specific server on the LAN at the active Zone Core will result in loss of the management function associated with the server, while the entire system will remain in the Wide Area Trunking mode. The failure is transparent to all radio and dispatch console users. The failure will affect the Network Management system user.
Protection:	Multiple servers running separate applications. Synchronized servers at an optional geographically separated Zone Core. Spare components for server computers.
Detection:	Alarm on Manager Terminal.

Table 4-32: Failure of Microwave Radio

Scenario:	Failure of a Microwave Radio
Result:	The proposed microwave radios are arranged in a Loop configuration on the backbone in addition to hot standby on all links. The failure of a microwave radio at any site on the network backbone will result in automatic reroute of traffic around the opposite direction on the loop, which will allow the system to continue to function in wide-area trunking while the radio is down. The failure of a microwave radio at any link will result in automatic switchover to the hot-standby/redundant radio. The entire system remains in the wide-area trunking mode. The failure is transparent to all system users. Dispatch console operation remains unaffected.
Protection:	Loop microwave radio links and/or hot standby radio configuration.

Table 4-33: Failure of Single Base Station at an ASTRO 25 Simulcast or Repeater Site

Scenario:	Failure of a Single Base Station
Result:	In a trunking system, multiple channels inherently provide redundancy. The failure of one base station will be transparent to all system users. The failure of a repeater will result in the ASTRO 25 Zone Controller removing the channel from the system, resulting in some reduced channel capacity. Any calls in progress on the failed channel will be lost, and on the next push-to-talk, radio traffic will be restored. All other channels in the ASTRO 25 repeater site or Simulcast cell remain unaffected. The entire system remains in the Wide Area Trunking mode. Dispatch console operation remains unaffected.
Protection:	Multiple channels, multiple potential control channels, spare modules.
Detection:	Alarm on Manager Terminal.

Table 4-34: Failure of a Single Control Channel

Scenario:	Failure of a Single Control Channel
Result:	Motorola trunking systems provide up to four possible control channels in an ASTRO 25 Simulcast or Repeater Site. If the currently active control channel fails, another channel automatically takes over and the control channel as the failed channel is automatically taken out of service. All other channels within the ASTRO 25 repeater or Simulcast cell remain unaffected. The ASTRO 25 repeater or Simulcast cell remains in the wide-area trunking mode. The failure is transparent to all system users. Dispatch console operation remains unaffected.
Protection:	Multiple potential control channels diversified across two cabinets.
Detection:	Alarm on Manager Terminal.

Table 4-35: Failure of a Single Dispatch Operator Position

Scenario:	Failure of a Single Dispatch Operator Position
Result:	The failure of a dispatch operator position will result in that particular dispatcher moving to another operator position or reverting to the fallback control station or portable radio. All other dispatch terminals operate normally and remain unaffected. The entire system remains in the Simulcast trunking mode.
Protection:	Fallback control stations, multiple independent dispatch positions.
Detection:	Console user detection, console diagnostics.

Table 4-36: Failure of a Dispatch Center Ethernet Switch

Scenario:	Failure of a Dispatch Center Ethernet Switch
Result:	The ASTRO 25 network was designed with dual Ethernet switches that connect the operator positions to the network. Any operator positions connected to the failed switch will be taken out of service. Upon notification of the switch failure, the impacted operator positions can be moved to the functional Ethernet switch.
Protection:	Dual switches. Spare switches.
Detection:	Console user detection, console diagnostics.

Failure Indications at Supervisory Console

The radio system's fault manager monitors and reports the status of all the hardware elements in the radio and console subsystems. The supervisory console at each dispatch center is provided with a fault management terminal, allowing the entire radio and console network to be fault managed from the same point the rest of the radio system is fault managed. The specific hardware elements that are monitored are the dispatch consoles and any networking equipment that support the console elements. Each hardware element monitors critical internal hardware sub-elements and reports its status. Failures within a hardware element are detected and displayed on the fault management terminal.

Table 4-37: Failure Mode Analysis Matrix

Event Causing Failure	Typical Strategy to Mitigate the Network Failure	Extraordinary Mitigation Strategy Proposed for Sumter County
Failure of Zone Controller A at the Zone Core	Redundant Zone Controllers at the Zone Core and spare boards for the Zone Controllers	Motorola has provided redundant Zone Controllers at the Zone Core. Failure of the active Zone Controller at the Zone Core will result in automatic switchover to the redundant Zone Controller. As the switchover process takes place, the system will temporarily enter site trunking mode for a period less than 60 seconds. Wide area trunking will be restored when the switchover process is complete. Any and all calls generated after automatic switchover to the redundant controller will not observe any change of service. During the transition, the dispatch operators will revert to operating on desktop Control Stations. The Zone Controllers have redundant power supplies as a standard feature, which will help keep the controllers operational in case of a failure of that component. The redundant controller is regularly updated with all pieces of critical information so that if it needs to become the active controller, the current system configuration and operational characteristics are maintained.

Event Causing Failure	Typical Strategy to Mitigate the Network Failure	Extraordinary Mitigation Strategy Proposed for Sumter County
Failure of Zone Controller A and B at the Zone Core	Spare boards, Optional Backup Zone Core at a geographically separate location, Backup WAN links at each remote Simulcast site, ASTRO 25 Trunked repeater site, and dispatch sites	In the unlikely event that both the active and redundant Zone Controllers fail, the system will automatically switch over to Site Trunking at all ASTRO 25 RF Sites. The ASTRO 25 Trunked RF sites will continue to trunk in their respective cells and coverage areas; however, there will be no direct linking of calls between the ASTRO 25 Simulcast Cell. Users within an RF cell will be able to operate in the trunking mode within their respective site's coverage. When the Zone Controllers come back online, the system will return to Wide Area Trunking.
Failure of a Zone Core LAN Switch at the Zone Core	Dual Zone Core Ethernet Switches	Motorola's ASTRO 25 system employs dual Zone Core Ethernet Switches at the Zone Cores. All equipment critical for wide-area voice communications has connections to both switches. Failure of one Ethernet Switch on the active Zone Core will cause the LAN traffic to use the other switch. The entire system remains in the Simulcast Wide Area Trunking mode. The failure is transparent to all system users.
Failure of both Zone Core LAN Switches at the Zone Core	Spare Enterprise Switch, Backup Zone Core at a physically separate location	In the unlikely event that both Zone Core LAN Switches fail at the Zone Core, the system will automatically switch over to Site Trunking at all ASTRO 25 RF Sites. The ASTRO 25 Trunked RF sites will continue to trunk in their respective cells and coverage areas; however, there will be no direct linking of calls between the ASTRO 25 Simulcast Cell. Users within an RF cell will be able to operate in the trunking mode within their respective site's coverage. When the LAN switches come back online, the system will return to Wide Area Trunking.
Failure of a Zone Core Router at the Zone Core	Redundant Core Router, Spare Core Router, Redundant site links	The Zone Core configuration for the proposed Sumter County system consists of redundant Core Routers. The Core Routers are configured so that all RF cells and dispatch centers are connected to both Core Routers. Failure of one Core Router at the active Zone Core will result in automatic switchover to the redundant Core Router. The entire system remains in Wide Area operation. The failure is transparent to all system users.
Failure of Both the Main and Redundant Core Routers at the Zone Core	Redundant Core Router, Spare Core Router, Redundant Site Links	The Zone Core configuration for the proposed Sumter County system consists of two Core Routers. The Core Routers are configured so that all RF cells and dispatch centers are connected to both Core Routers. In the unlikely event that both Core Routers fail, the system will automatically switch over to Site Trunking at all ASTRO 25 RF Sites. The ASTRO 25 Trunked RF sites will continue to trunk in their respective cells and coverage areas; however, there will be no direct linking of calls between the ASTRO 25 Simulcast Cell. Users within an RF cell will be able to operate in the trunking mode within their respective site's coverage. When the Zone Controllers come back online, the system will return to Wide Area Trunking.

Event Causing Failure	Typical Strategy to Mitigate the Network Failure	Extraordinary Mitigation Strategy Proposed for Sumter County
Failure of the Network Management Server at the Zone Core	Multiple servers running separate applications, Synchronized servers at an optional geographically separated Zone Core, Spare components for server computers	The failure of any specific server on the LAN at the active Zone Core will result in loss of the management function associated with the server, while the entire system will remain in the Wide Area Trunking mode. The failure is transparent to all radio and dispatch console users. The failure will affect the Network Management system user.
Failure of a Microwave Radio	Loop microwave radio links or hot standby radio configuration	The proposed microwave radios are hot standby for loop links. The failure of a microwave radio at any site on the network backbone will result in automatic switchover to the hot-standby/redundant radio for spur links and reversal of loop direction for loop radio links. The entire system remains in the wide-area trunking mode. The failure is transparent to all system users. Dispatch console operation remains unaffected.
Failure of a Microwave Path	Loop-path configuration, Redundant Ethernet links	The failure of a microwave path between any site on the backbone loop will cause the loop traffic to reroute around the break and the system will remain in Wide Area Trunking. The failure of a microwave path between any spur site will result in loss of dispatch connectivity for the site separated by the break on the spur. The system will remain in Wide Area Trunking and the affected dispatch center(s) will switch to control stations for dispatch operations. Motorola has also proposed redundant site routers.
Failure of a single Base Station	Multiple channels, multiple potential control channels, spare modules	In a trunking system, multiple channels inherently provide redundancy. The failure of one base station will be transparent to all system users. The failure of a repeater will result in the ASTRO 25 Zone Controller removing the channel from the system, resulting in some reduced channel capacity. Any calls in progress on the failed channel will be lost, and on the next push-to-talk, radio traffic will be restored. All other channels in the ASTRO 25 repeater cell remain unaffected. The entire system remains in the Wide Area Trunking mode. Dispatch console operation remains unaffected.

Event Causing Failure	Typical Strategy to Mitigate the Network Failure	Extraordinary Mitigation Strategy Proposed for Sumter County
Failure of a Single Control Channel	Multiple potential control channels	Motorola trunking systems provide up to four possible control channels in an ASTRO 25 RF Site. If the currently active control channel fails, another channel automatically takes over and the control channel as the failed channel is automatically taken out of service. All other channels within the ASTRO 25 RF cell remain unaffected. The ASTRO 25 RF cell remains in the wide-area trunking mode. The failure is transparent to all system users. Dispatch console operation remains unaffected.
Failure of a Single Dispatch Operator Position	Fallback control stations, multiple independent dispatch positions	The failure of a dispatch operator position will result in that particular dispatcher moving to another operator position or reverting to a fallback control station or portable radio. All other dispatch terminals operate normally and remain unaffected. The entire system remains in the trunking mode.

4.4 System Drawings

Motorola has provided system drawings and diagrams on the following pages.

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Sumter County, FL – Interoperability System Design

Customer Provided Control Stations for:
*State of Florida System
*SOF Mutual Aid
*Pasco County EDACS

4-Wire Connections to Additional Radios and/or Repeaters

Interop Gateway

Interop Gateway

4-Wire Connection

Motobridge Florida Interop Network (FIN)

Motobridge FIN Connections to:
Polk Co
Fish and Wildlife
Florida State Patrol
Florida Forest Service
Florida DOT
RDSTF Region IV
U.S. Coast Guard
SOF Division of Forestry

ISSI GW #1 Included

ISSI GW #2 (Option)

ISSI GW #3 (Option)

T1 or Ethernet Link

T1 or Ethernet Link

T1 or Ethernet Link

P25 ISSI Gateway

ASTRO 25 IP CORE

Wireline Control via IP Microwave

Proposed 8TAC Channels (5)

Digital Interop Gateway

MCC 7500 Dispatch Sites (3)

Voice and Trunking IDs

APX7500 Consolette with ACIM
Affiliated to Citrus County

Voice and Trunking IDs

APX7500 Consolette with ACIM
Affiliated to Hernando County

Voice and Trunking IDs

Voice and Trunking IDs

APX7500 Consolette with ACIM
Affiliated to Lake County

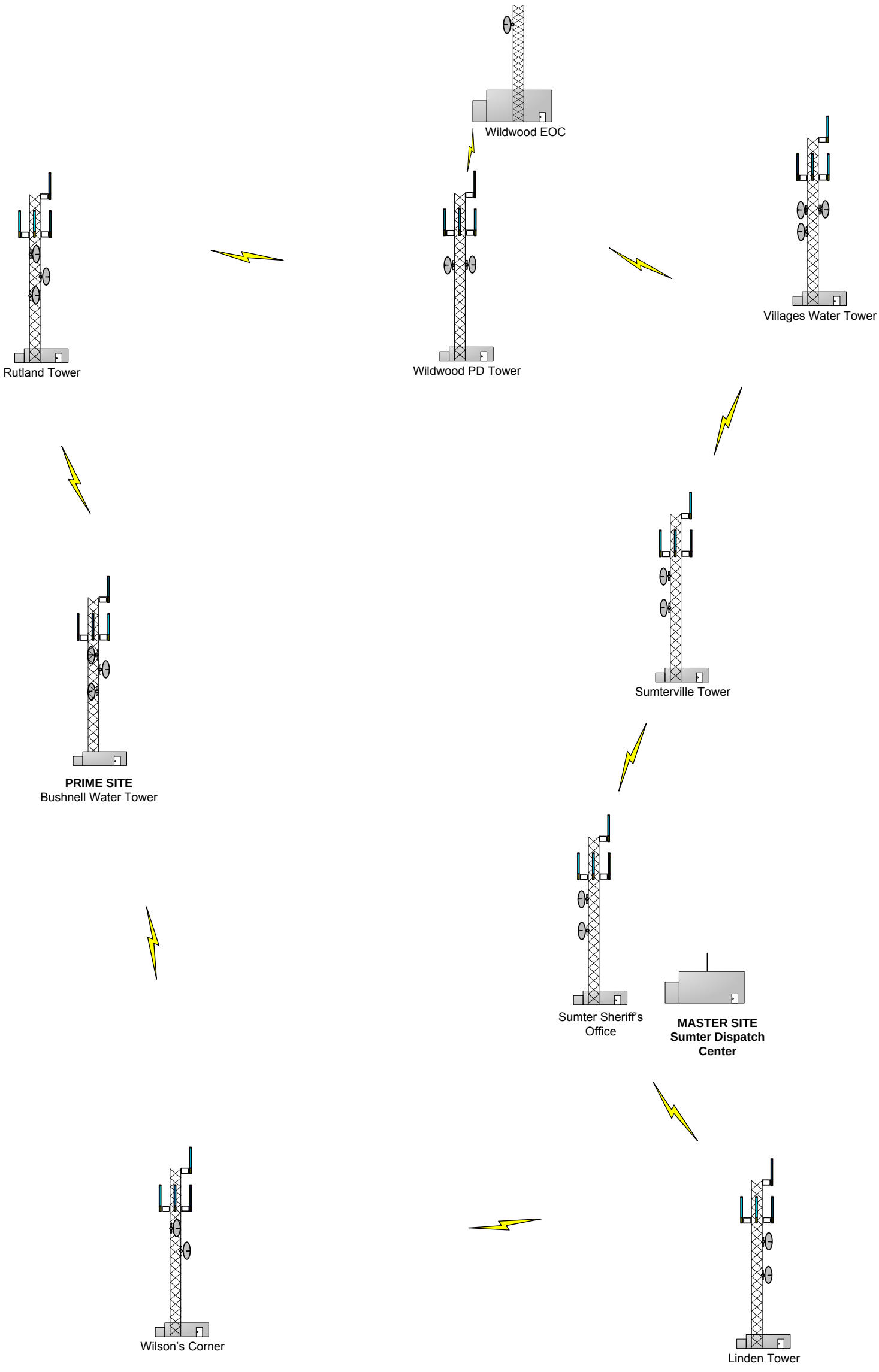
APX7500 Consolette with ACIM
Affiliated to Marion County

REV	DATE	ENGNR	DESCRIPTION
H			
G			
F			
E			
D			
C			
B			
A			
O	10/10/11	J.Castillo	Interoperability System Connections

MOTOROLA

Networks & Enterprise
Systems Engineering
Lake Mary, FL 30043

PROJECT: Sumter County, FL - ASTRO 25 10 Channel Simulcast Sub-Site				
TITLE: SYSTEM DIAGRAM – Simulcast Remote RF				
CONTRACT	ENGINEER James Castillo	PROGRAM MGR	SCALE NONE	SIZE B
PROGRAM	DRAWN James Castillo	CHECKED	SHEET 1 of 1	REV O
FILE	DATE 10/26/11	CODE IDENT	DWG NO PRJ-xxx	



REV	DATE	ENGNR	DESCRIPTION
C			
B			
A			
O	10/12/11	JC	ORIGINAL RELEASE

MOTOROLA

Eastern Division
Systems Engineering

PROJECT:
Sumter County 800 MHz ASTRO25 Simulcast System

TITLE
System Overview Topology Diagram

CONTRACT	ENGINEER	PROGRAM MGR	SCALE	SIZE
	J.Castillo		None	B
PROGRAM	DRAWN	CHECKED	SHEET	REV
	JC			O
FILE	DATE	CODE IDENT	DWG NO	
	10/12/2011			

To Prime Site Routers via Microwave Link

Backhaul SW #1 HP-2610

Backhaul SW #2 HP-2610

MNI Proteus MX uW to Sumterville

MNI Proteus MX uW to Linden Tower

HP DL360 - IV&D PDG

SUN T5220 Servers

ZC01,UEM,UNC/UCS,ATR and ZDS

ZC02

ISSI

ST6000 Core Router #1

ST6000 Core Router #2

Ethernet

Gbit to SW #2

Gbit to SW #1

HP-3500 Core LAN Switch # 1

HP-3500 Core LAN Switch # 2

Ethernet Links to Co-located MCC7500 Ethernet LAN Switches

ST6000 Gateway Router #1

ST6000 Gateway Router #2

ST6000 GGSN Router

Ethernet

HP DL360-G6 VMS - CSMS / FW / GMC

Trak NTP Server on Prime Site

Ethernet

Ethernet

SDM3000 MOSCAD SNT

To All Windows Boxes

16 Port KVM w/LCD Monitor

Juniper Firewall

DMZ Switch HP2610

ST6000 PN Router

Customer Enterprise Network (CEN)

DL360 Server

Presence Notifier Server

HP 2610-24

CEN Switch

ST6000 Router

CEN Border Router

Out of Band Management – 48 ports

16 port w/ 1 internal dial-up modem

Servers, Routers, Switches, etc...

(Connections to device console ports not shown)

AIS VPM

AIS 1

NICE IP Logger HP DL360-G6

Note:

- Ethernet
- 5MHz
- 1 pps
- Data (RS232)
- 4 W Audio

REV	DATE	ENGNR	DESCRIPTION
C			
B			
A			
O	10/11/11	JC	ORIGINAL RELEASE

MOTOROLA

Eastern Division
Systems Engineering

PROJECT: Sumter County 800 MHz ASTRO25 Simulcast System

TITLE: Master Site – Block diagram

CONTRACT	ENGINEER	PROGRAM MGR	SCALE	SIZE
	J.Castillo		None	B
PROGRAM	DRAWN	CHECKED	SHEET	REV
	JC			O
FILE	DATE	CODE IDENT	DWG NO	
	10/12/11			

To Rutland

GCP8000 Simulcast Redundant Controllers

To Master Site
Core Router Backhaul SWs
via MNI Microwave CAT5e

#1 Site GCM8000 Router

GCP8000 Simulcast Redundant Controllers

MNI Proteus MX uW

To Co-Remote Site Router #1

Mesh configuration To All switches

#1 LAN Switch HP2610

Mesh configuration To All switches

#2 LAN Switch HP2610

GCM8000 Voting Comparators – CH 1,5,9

GCM8000 Voting Comparators – CH 2,6

#1 Sub-Site GCM8000 Router

Site Backhaul SW #1 HP2610

Serial Alarms

Serial AlarmsTo Console MNI uW spurs on Master Site

SDM3000 MOSCAD RTUs

Site Environmental Alarms & Control

Mesh configuration To All switches

#3 LAN Switch HP2610

Mesh configuration To All switches

#4 LAN Switch HP2610

Site Backhaul SW #2 HP2610

#2 Sub-Site GCM8000 Router

GCM8000 Voting Comparators – CH 3,7

GCM8000 Voting Comparators – CH 4,8

Serial Alarms

To Wilsons Corner

Bridge to West

MNI Proteus MX uW

To Co-Remote Site Router #2

Note:
- Ethernet
- 5MHz
- 1 pps
- Data (RS232)
- 4 W Audio

REV	DATE	ENGNR	DESCRIPTION
C			
B			
A			
O	10/12/11	JC	ORIGINAL RELEASE

MOTOROLA

Eastern Division
Systems Engineering

PROJECT: Sumter County 800 MHz ASTRO 25 Simulcast System

TITLE: Site 1 Bushnell Water Tower Prime Site – Block diagram

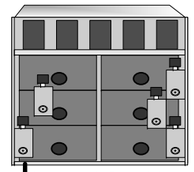
CONTRACT	ENGINEER	PROGRAM MGR	SCALE	SIZE
	J. Castillo		None	B
PROGRAM	DRAWN	CHECKED	SHEET	REV
	JC			O
FILE	DATE	CODE IDENT	DWG NO	
	10/12/11			

To co-located MNI Microwave

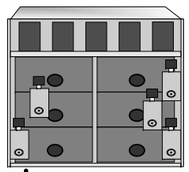
#1 Site GCM8000 Router

To Tx Antenna 1

To Tx Antenna 2



Internal Combiner 1



Internal Combiner 2

To TTA & Rx Antenna

Rx Multi-coupler (16 Ch)

MOSCAD RTU

48 DI
16 DO
For environmental alarms

GPS

GPS

MA-TAC1

GGM8000 – CCGW # 1

To co-located MNI Microwave

#2 Site GCM8000 Router

Note:
- Ethernet
- 5MHz
- 1 pps
- Data (RS232)
- 4 W Audio

REV	DATE	ENGNR	DESCRIPTION
C			
B			
A			
O	10/12/11	JC	ORIGINAL RELEASE

MOTOROLA

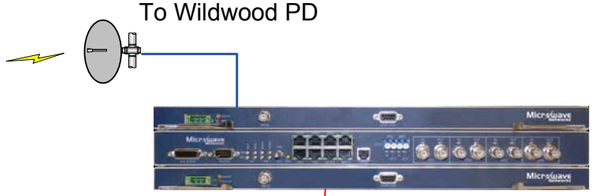
Eastern Division
Systems Engineering

PROJECT:
Sumter County 800 MHz ASTRO25 Simulcast System

TITLE
Site 1 Bushnell Water Tower Simulcast Co-Located Remote Site – Block diagram

CONTRACT	ENGINEER J.Castillo	PROGRAM MGR	SCALE None	SIZE B
PROGRAM	DRAWN JC	CHECKED	SHEET	REV O
FILE	DATE 10/12/11	CODE IDENT	DWG NO	

To Wildwood PD



MNI Proteus MX uW

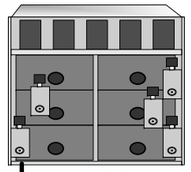
#1 Site GCM8000 Router

To Tx Antenna 1

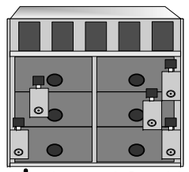
To Tx Antenna 2

To TTA
&
Rx Antenna

Rx Multi-coupler (16 Ch)



Internal Combiner 1



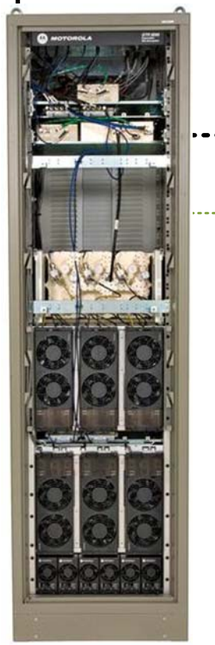
Internal Combiner 1

MA-TAC3

GGM8000 - CCGW

Citrus County
Interoperabilty Control
Station

GPS

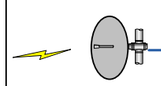


GPS

MOSCAD RTU

48 DI
16 DO
For environmental alarms

To Bushnell
Water Tower



MNI Proteus MX uW

#2 Site GCM8000 Router

Note:

- Ethernet
- 5MHz
- 1 pps
- Data (RS232)
- 4 W Audio

REV	DATE	ENGNR	DESCRIPTION
C			
B			
A			
O	10/12/11	JC	ORIGINAL RELEASE

MOTOROLA

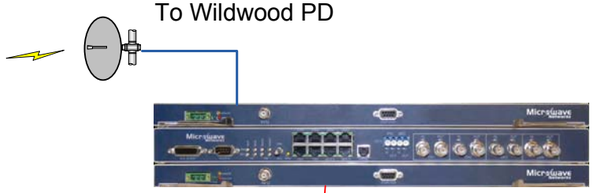
Eastern Division
Systems Engineering

PROJECT:
Sumter County 800 MHz ASTRO25 Simulcast System

TITLE
Site 2 Rutland Simulcast Remote Site – Block diagram

CONTRACT	ENGINEER	PROGRAM MGR	SCALE	SIZE
	J.Castillo		None	B
PROGRAM	DRAWN	CHECKED	SHEET	REV
	JC			O
FILE	DATE	CODE IDENT	DWG NO	
	10/12/11			

To Wildwood PD

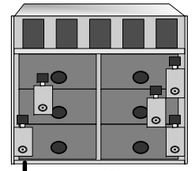


MNI Proteus MX uW

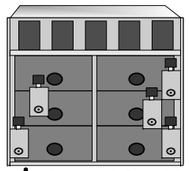
#1 Site GCM8000 Router

To Tx Antenna 1

To Tx Antenna 2



Internal Combiner 1



Internal Combiner 2

To TTA
&
Rx Antenna

Rx Multi-coupler (16 Ch)

MA-CALL

GGM8000 - CCGW

Marion County
Interoperabilty Control
Station

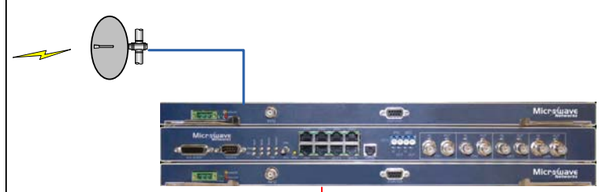
GPS

GPS

MOSCAD RTU

48 DI
16 DO
For environmental alarms

To Sumterville



MNI Proteus MX uW

#2 Site GCM8000 Router

Note:

- Ethernet
- 5MHz
- 1 pps
- Data (RS232)
- 4 W Audio

REV	DATE	ENGNR	DESCRIPTION
C			
B			
A			
O	10/12/11	JC	ORIGINAL RELEASE

MOTOROLA

Eastern Division
Systems Engineering

PROJECT:
Sumter County 800 MHz ASTRO25 Simulcast System

TITLE
Site 3 Villages Simulcast Remote Site – Block diagram

CONTRACT	ENGINEER	PROGRAM MGR	SCALE	SIZE
	J.Castillo		None	B
PROGRAM	DRAWN	CHECKED	SHEET	REV
	JC			O
FILE	DATE	CODE IDENT	DWG NO	
	10/12/11			

To Sumter SO

MNI Proteus MX uW

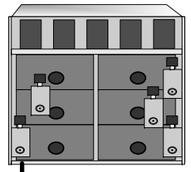
#1 Site GCM8000 Router

MA-TAC2

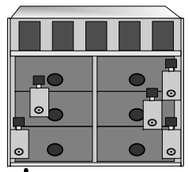
GGM8000 - CCGW

To Tx Antenna 1

To Tx Antenna 2



Internal Combiner 1



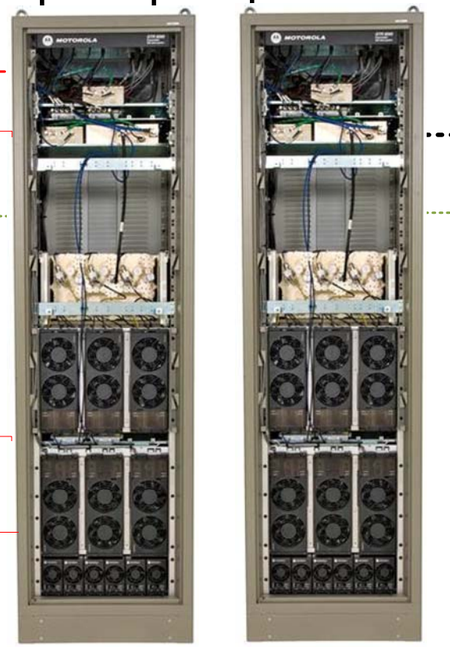
Internal Combiner 2

To TTA
&
Rx Antenna

Rx Multi-coupler (16 Ch)

GPS

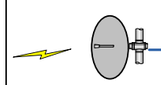
GPS



MOSCAD RTU

48 DI
16 DO
For environmental alarms

To Villages
Water Tower



MNI Proteus MX uW

#2 Site GCM8000 Router

Note:

- Ethernet
- 5MHz
- 1 pps
- Data (RS232)
- 4 W Audio

REV	DATE	ENGNR	DESCRIPTION
C			
B			
A			
O	10/12/11	JC	ORIGINAL RELEASE

MOTOROLA

Eastern Division
Systems Engineering

PROJECT:
Sumter County 800 MHz ASTRO25 Simulcast System

TITLE
Site 4 Sumterville Simulcast Remote Site – Block diagram

CONTRACT	ENGINEER	PROGRAM MGR	SCALE	SIZE
	J.Castillo		None	B
PROGRAM	DRAWN	CHECKED	SHEET	REV
	JC			O
FILE	DATE	CODE IDENT	DWG NO	
	10/12/11			

To Sumter SO

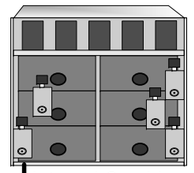
MNI Proteus MX uW

#1 Site GCM8000 Router

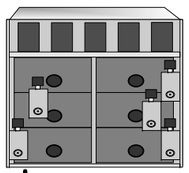
To Tx Antenna 1

To Tx Antenna 2

To TTA
&
Rx Antenna



Internal Combiner 1



Internal Combiner 2

Rx Multi-coupler (16 Ch)

MA-TAC4

GGM8000 - CCGW

GPS

GPS

MOSCAD RTU

48 DI
16 DO
For environmental alarms

To Wilsons
Corner

MNI Proteus MX uW

#2 Site GCM8000 Router

Note:
- Ethernet
- 5MHz
- 1 pps
- Data (RS232)
- 4 W Audio

REV	DATE	ENGNR	DESCRIPTION
C			
B			
A			
O	10/12/11	JC	ORIGINAL RELEASE

MOTOROLA

Eastern Division
Systems Engineering

PROJECT:
Sumter County 800 MHz ASTRO25 Simulcast System

TITLE
Site 5 Linden American Tower Simulcast Remote Site – Block diagram

CONTRACT	ENGINEER	PROGRAM MGR	SCALE	SIZE
	J.Castillo		None	B
PROGRAM	DRAWN	CHECKED	SHEET	REV
	JC			O
FILE	DATE	CODE IDENT	DWG NO	
	10/12/11			

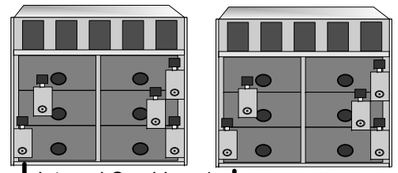
To Linden
American Tower

MNI Proteus MX uW

#1 Site GCM8000 Router

To Tx Antenna 1

To Tx Antenna 2



Internal Combiner 1

Internal Combiner 2

To TTA
&
Rx Antenna

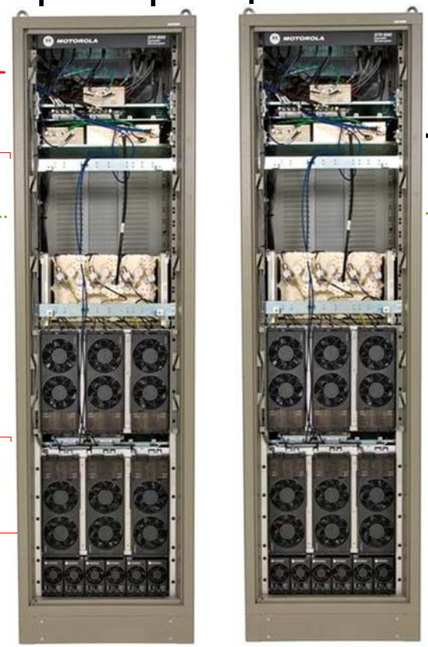
Rx Multi-coupler (16 Ch)

GGM8000 - CCGW

Hernando County
Interoperabilty Control
Station

GPS

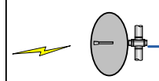
GPS



MOSCAD RTU

48 DI
16 DO
For environmental alarms

To Bushnell Water
Tower



MNI Proteus MX uW

#2 Site GCM8000 Router

Note:

- Ethernet
- 5MHz
- 1 pps
- Data (RS232)
- 4 W Audio

REV	DATE	ENGNR	DESCRIPTION
C			
B			
A			
O	10/12/11	JC	ORIGINAL RELEASE

MOTOROLA

Eastern Division
Systems Engineering

PROJECT:
Sumter County 800 MHz ASTRO25 Simulcast System

TITLE
Site 6 Wilsons Corner Simulcast Remote Site – Block diagram

CONTRACT	ENGINEER	PROGRAM MGR	SCALE	SIZE
	J.Castillo		None	B
PROGRAM	DRAWN	CHECKED	SHEET	REV
	JC			O
FILE	DATE	CODE IDENT	DWG NO	
	10/12/11			

Existing Sumter County Control Stations (4W)

#1 GCM8000 CCGW Router

#1 Console Site GCM8000 Router

Common for Sumterville & Linden Tower

MNI Proteus MX uW

#2 GCM8000 CCGW Router

Existing Sumter County Control Stations (4W)

#2 Console Site GCM8000 Router

SDM3000 Console I/Os

Console Public I/Os

SDM3000 MOSCAD RTU

Site Environmental Alarms

Microwave Serial Alarms

#1 LAN SW HP2610-24

Gbit jmpr To switch 2

#2 LAN SW HP2610-24

Gbit jmpr To switch 1

Moscad GWS and Network Manager

Network Printer

#3 GCM8000 CCGW Router

Lake County Interoperabilty Control Station

MCC7500 OP1

VPM

MCC7500 OP 6

VPM

Note:
- Ethernet
- 5MHz
- 1 pps
- Data (RS232)
- 4 W Audio

REV	DATE	ENGNR	DESCRIPTION
C			
B			
A			
O	10/1/2/11	JC	ORIGINAL RELEASE

MOTOROLA

Eastern Division
Systems Engineering

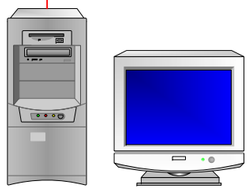
PROJECT:
Sumter County 800 MHz ASTRO25 Simulcast System

TITLE
Sumter Sheriff's Communications Center Consoles – Block diagram

CONTRACT	ENGINEER	PROGRAM MGR	SCALE	SIZE
	J. Castillo		None	B
PROGRAM	DRAWN	CHECKED	SHEET	REV
	JC			O
FILE	DATE	CODE IDENT	DWG NO	
	10/12/11			

LAN SW HP2610-24

- **Inform lite point server**



Nice Inform Lite Replay

Note:
Ethernet
T1

REV	DATE	ENGNR	DESCRIPTION
C			
B			
A			
O	10/12/11	JC	ORIGINAL RELEASE

MOTOROLA

Eastern Division
Systems Engineering

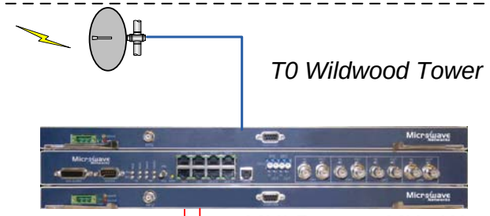
PROJECT:
Sumter County 800 MHz ASTRO25 Simulcast System

TITLE
Sumter SO Communications Center Telephony Interface – Block diagram

CONTRACT	ENGINEER	PROGRAM MGR	SCALE	SIZE
	J. Castillo		None	B
PROGRAM	DRAWN	CHECKED	SHEET	REV
	JC			O
FILE	DATE	CODE IDENT	DWG NO	
	10/12/11			

#1 GCM8000 CCGW Router

T0 Wildwood Tower



MNI Proteus MX uW

#2 GCM8000 CCGW Router

SDM3000 Console I/Os

Console Public I/Os

#1 Console Site GCM8000 Router

#2 Console Site GCM8000 Router

SDM3000 MOSCAD RTU

Site Environmental Alarms

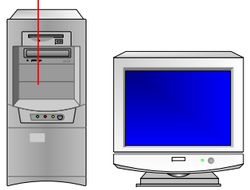
#1 LAN SW HP2610-24

Gbit jmpr To switch 2

Conventional Site Controller GCP8000

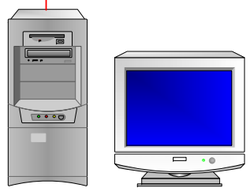
#2 LAN SW HP2610-24

Gbit jmpr To switch 1

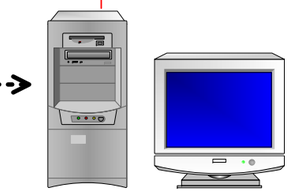


Moscad GWS and Network Manager

Network Printer



MCC7500 OP1



MCC7500 OP 3

MOTOROLA

VPM

MOTOROLA

VPM

Note:

- Ethernet
- 5MHz
- 1 pps
- Data (RS232)
- 4 W Audio

REV	DATE	ENGNR	DESCRIPTION
C			
B			
A			
O	10/12/11	JC	ORIGINAL RELEASE

MOTOROLA

Eastern Division
Systems Engineering

PROJECT:
Sumter County 800 MHz ASTRO25 Simulcast System

TITLE
Wildwood PD Communications Center Backup EOC Consoles – Block diagram

CONTRACT	ENGINEER	PROGRAM MGR	SCALE	SIZE
	J. Castillo		None	B
PROGRAM	DRAWN	CHECKED	SHEET	REV
	JC			O
FILE	DATE	CODE IDENT	DWG NO	
	10/1/2/11			

#1 GCM8000 CCGW Router

#2 GCM8000 CCGW Router

Customer Provided Fiber to Master Site

SDM3000 Console I/Os

Console Public I/Os

SDM3000 MOSCAD RTU

Site Environmental Alarms

#1 Console Site GCM8000 Router

#2 Console Site GCM8000 Router

#1 LAN SW HP2610-24

Gbit jmpr To switch 2

Gbit jmpr To switch 1

#2 LAN SW HP2610-24

Conventional Site Controller GCP8000

Moscad GWS and Network Manager

Network Printer

MCC7500 OP1

MCC7500 OP 6

VPM

VPM

Note:
- Ethernet
- 5MHz
- 1 pps
- Data (RS232)
- 4 W Audio

REV	DATE	ENGNR	DESCRIPTION
C			
B			
A			
O	10/12/11	JC	ORIGINAL RELEASE

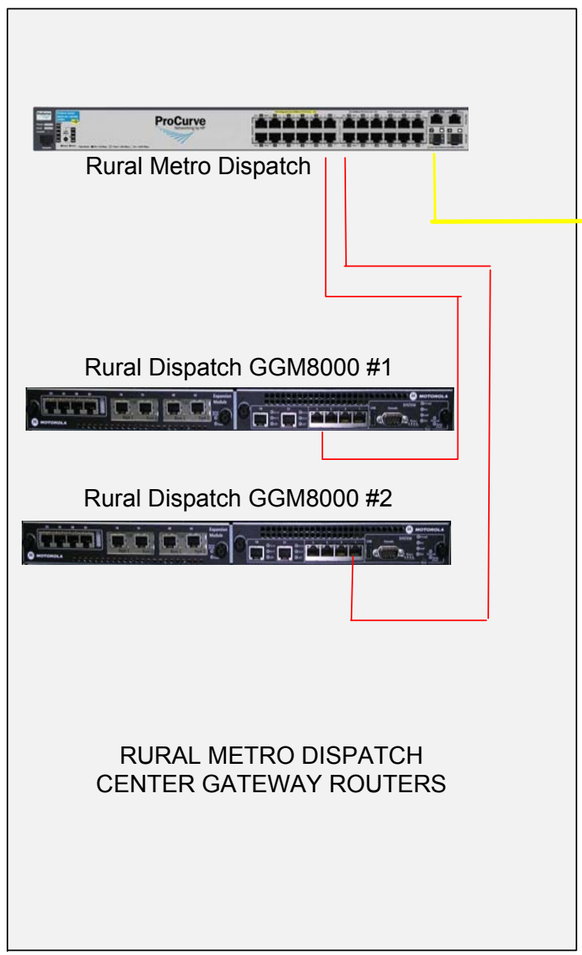
MOTOROLA

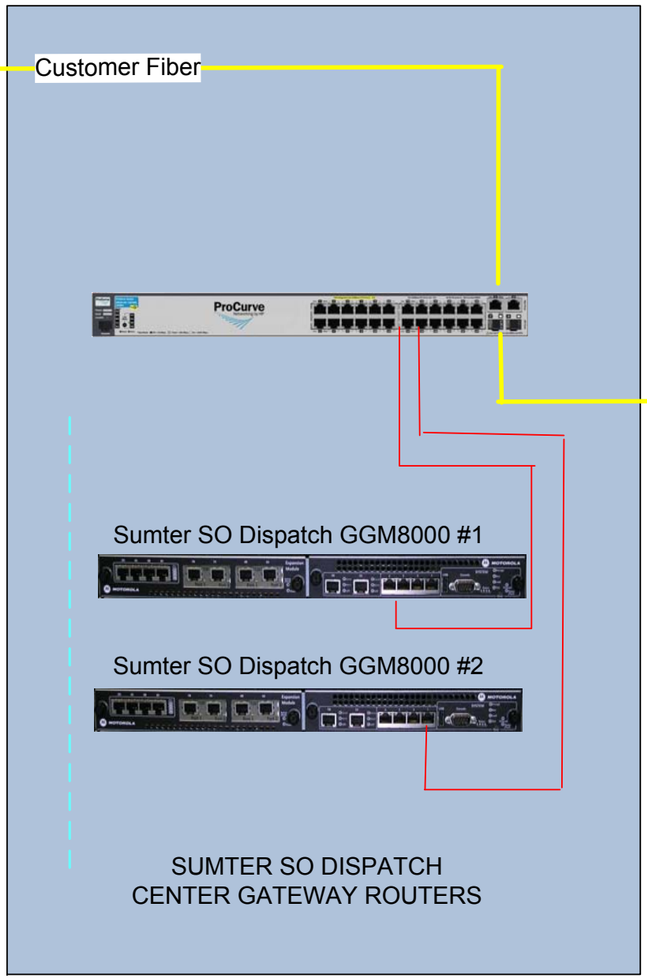
Eastern Division
Systems Engineering

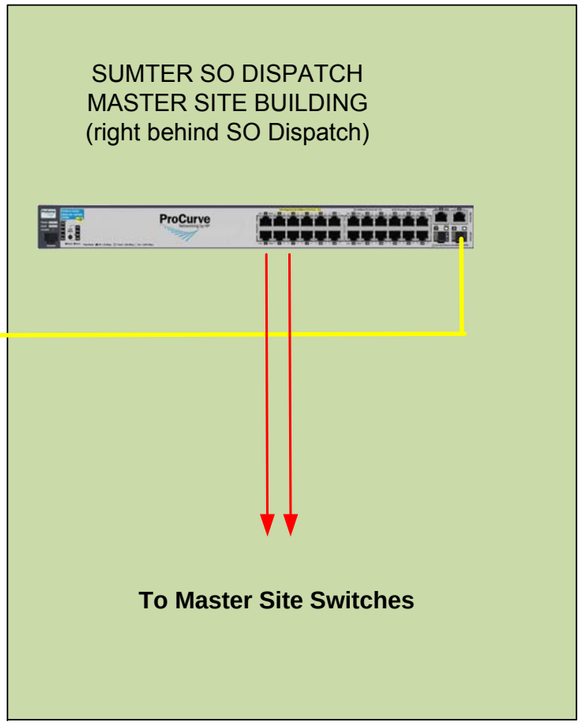
PROJECT: Sumter County 800 MHz ASTRO25 Simulcast System

TITLE: Rural Metro Consoles – Block diagram

CONTRACT	ENGINEER	PROGRAM MGR	SCALE	SIZE
	J. Castillo		None	B
PROGRAM	DRAWN	CHECKED	SHEET	REV
	JC			O
FILE	DATE	CODE IDENT	DWG NO	
	10/1/2/11			







Fiber

Note:
- Ethernet
- 5MHz
- 1 pps
- Data (RS232)
- 4 W Audio

REV	DATE	ENGNR	DESCRIPTION
C			
B			
A			
O	10/12/11	JC	ORIGINAL RELEASE

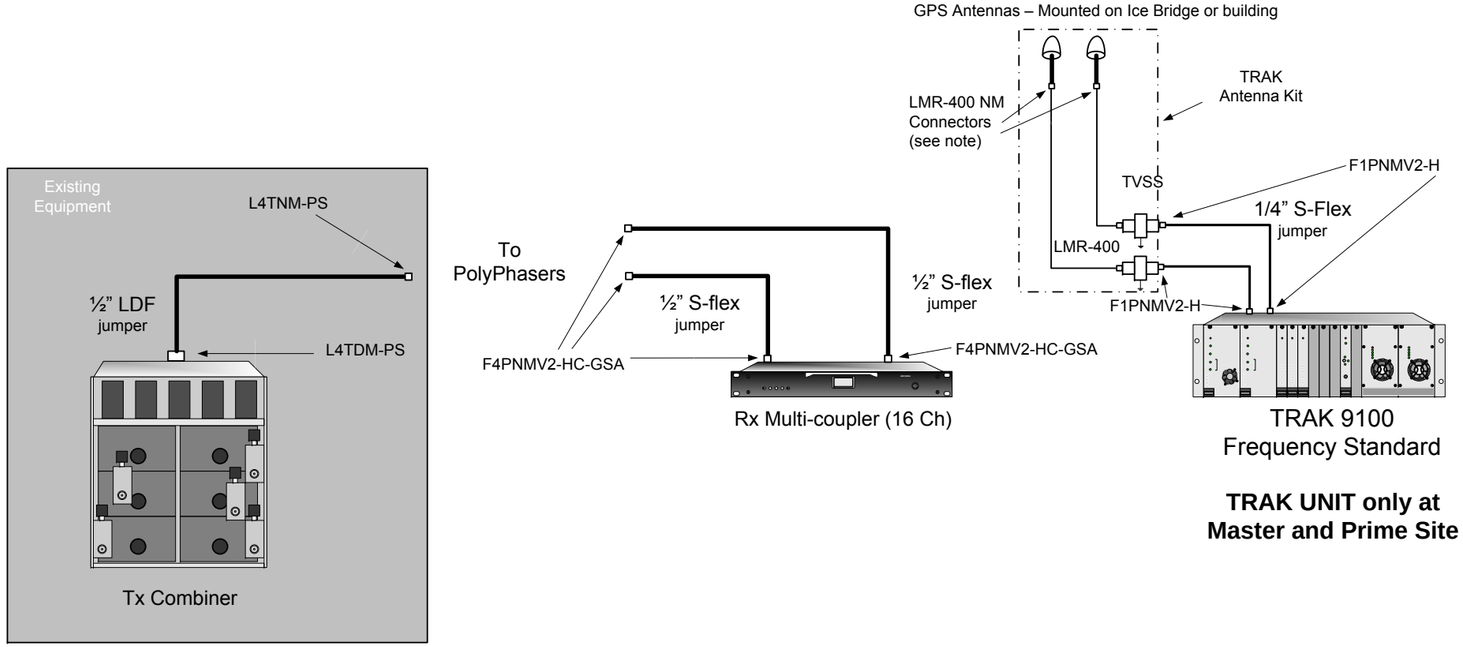
MOTOROLA

Eastern Division
Systems Engineering

PROJECT:
Sumter County 800 MHz ASTRO 25 Simulcast System

TITLE
Rural Metro and SO Dispatch Interconnect Diagram

CONTRACT	ENGINEER J. Castillo	PROGRAM MGR	SCALE None	SIZE B
PROGRAM	DRAWN JC	CHECKED	SHEET	REV O
FILE	DATE 10/12/11	CODE IDENT	DWG NO	



TRAK UNIT only at Master and Prime Site

800 Antenna Network Configuration – All Sites

Note:
- There are (1) Rx MC per site & (2) Tx Comb per site, except the Bushnell Water Tower
- The LMR-400 connectors come installed on one end of the LMR cable

REV	DATE	ENGNR	DESCRIPTION
C			
B			
A			
O	10/12/11	JC	ORIGINAL RELEASE

MOTOROLA

Eastern Division
Systems Engineering

PROJECT: Sumter County 800 MHz ASTRO25 Simulcast System

TITLE: Site Antenna Network to Equipment Diagram

CONTRACT	ENGINEER	PROGRAM MGR	SCALE	SIZE
	J. Castillo		None	B
PROGRAM	**DRAWN**	**CHECKED**	**SHEET**	**REV**
	JC			O
FILE	DATE	CODE IDENT	DWG NO	
	10/12/11			

4.5 Alternate System Description

In addition to our primary RFP compliant offering, Motorola has also developed an alternate design as described below and included in the Infrastructure/Subscriber Equipment Pricing Response. Motorola understands that Sumter County might like to consider opportunities to leverage the previous investment in The Villages ASR site as well as to investigate the option to share existing resources with Lake County. This alternate approach would allow Sumter County to realize an immediate savings specific to a reduction in required infrastructure equipment as well as future savings with regard to a reduced cost of ownership. In addition to cost savings, this approach also represents both technical and operational advantages with regard to interoperability between Sumter County and Lake County. The opportunity for seamless roaming between Sumter County and Lake County is acknowledged in the *Public Safety Radio Consulting Services Conceptual Solutions Report* developed for Sumter County by Tusa Consulting: “Although interoperable communications can be achieved with all adjacent counties, true ‘seamless’ roaming can only occur between counties that share a Master Site Switch”. This report also suggests that it would be advantageous for Sumter County to investigate leveraging components of the existing Lake County ASTRO 25 system: “it appears as though the most beneficial approach will be for Sumter to share radio resources with Lake County”.

Motorola acknowledges the importance of the system requirements as identified in the RFP document. We have developed an alternate design for consideration by Sumter County that incorporates the critical elements regarding capacity and coverage consistent with our primary RFP compliant offering.

Our proposed alternate design meets all the following RFP requirements:

- Coverage.
- Microwave system.
- Dispatch system capability.
- Continued operation of existing Sumter County conventional RF backbone.
- System-wide interoperability.
- Automatic roaming.
- Project 25 Common Air Interface (CAI) and 9600 bps control channel.
- Effective radio channel management.
- Fast and reliable communications protocol.
- Advanced IP-based system architecture.
- Trunking specific mobile and portable radios.
- Alarms and diagnostics.

Our proposed alternate design includes the following elements of differentiation from the primary proposal:

- Elimination of the ASTRO 25 Master site.
- Connectivity and utilization of the Lake County Master site.
- Reuse and reprogramming of The Villages existing 6-channel ASR site to develop a 9-channel simulcast site.
- Utilization of The Villages to Lady Lake microwave path as well as access to the Lake County microwave loop network.
- Software upgrade of the existing Lake County system to the latest version of the ASTRO 25 platform, consistent with the RFP requirements and Sumter County equipment.

Motorola acknowledges that in order for Sumter County to consider a solution sharing resources with Lake County that a Memorandum of Understanding would be required from both parties identifying the terms and ensuring mutual benefit. This will be negotiated directly between the system parties; however, Motorola has determined the technical feasibility of this approach and has shared this option with Lake County with favorable feedback.

This requirement was also introduced in the *Public Safety Radio Consulting Services Conceptual Solutions Report*: “Likewise, an MOU between Sumter and another county should take place after proposals have been received. This allows both counties to ensure that the expected resource sharing and mutual benefit is acceptable before a vendor's proposal has been formally chosen”.

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Section 5. Functional Acceptance Test Procedures

5.1 ASTRO Acceptance Test Plan

Sumter County, Florida

ASTRO 25 System 7.11

In-Plant Draft

www.motorolasolutions.com/services/government

Representative 1 Name
Field Program Manager
(XXX) XXX-XXXX

James Castillo
Field Engineer
(407) 468-2879

5.1.1 Audio IP Logging

5.1.1.1 Logging Secure Trunking Talkgroup Call

1. DESCRIPTION

This test will demonstrate the Archiving Interface Server (AIS) can be used to log trunking talkgroup call audio for call in a secure transmit mode on a given talkgroup. The audio is archived in a vocoded decrypted format (IMBE for Trunking Talkgroup Call) only when the logging system user requested coded audio to be logged.

SETUP

The AIS at MCC7500 Console site is affiliated to TALKGROUP 1 and has the appropriate secure keys loaded.
RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - SITE 1
CONSOLE-1 - TALKGROUP 1

VERSION #1.040

2. TEST

Step 1. Initiate PTT from RADIO-1 on TALKGROUP 1 in a secure transmit mode.

Step 2. Observe that the call audio is being sent to the logging system by the playback application.

Step 3. If TALKGROUP 1 is marked to receive coded audio verify the coded audio can be played back via the application.

Step 4. Observe that the events for the TALKGROUP 1 call is logged even if the TALKGROUP 1 is not marked to receive coded audio.

Pass____ Fail____

Audio IP Logging

5.1.1.2 Logging Subsystem - Emergency Events and Calls-Emergency Alarm

1. DESCRIPTION

This test will demonstrate that upon receiving notification from the Zone Controller of an Emergency Acknowledge/Recognize issued for a resource that the AIS is monitoring, the AIS will report the event to the Logging System.

SETUP

RADIO-1 TALKGROUP 1
CONSOLE-1 TALKGROUP 1
AIS, NICE play back station and record station connected to AIS via the site LAN switch.
Configure an alias for RADIO-1 and RADIO-2 and allow adequate time for data propagation.

VERSION #1.060

2. TEST

Step 1. Start an emergency alarm from RADIO-1.

Step 2. Verify that a RADIO-1 displays a emergency indication and CONSOLE-1 gets the Emergency indication.

Step 3. Key up RADIO-1 on TALKGROUP 1. Verify that CONSOLE-1 receives audio on TALKGROUP 1.

Step 4. Playback recent TALKGROUP 1 call activities.

Step 5. Verify that the logging system has recorded the emergency alarm call/events with correct Resource Alias, Individual Alias, Site ID and the zone ID.

Pass____ Fail____

5.1.1.3 Logging Analog Conventional Call

1. DESCRIPTION

The IP-based analog conventional feature provides radio users/dispatcher capability to communicate with other radio users/dispatchers listening to the channel. The control events/voice from the transmitting radio or MCC 7500 Console can be forwarded to the archiving device that can record the information. This test will demonstrate the Archiving Interface Server (AIS) can be used to log analog conventional call audio/events on given analog conventional channel. The audio is archived in a vocoded format (G.728 for analog conventional).

SETUP

RADIO-1 - CCH1
CONSOLE-1 - CCH1
This test requires an operational CCGW with an analog conventional channel (CCH1) and AIS/third party logging equipment.
This test also requires an AIS affiliated to the CCH1. This is done via API commands from the third party logging system.

VERSION #1.030

2. TEST

Step 1. Initiate PTT from RADIO-1 on CCH1.

Step 2. Using the playback station and logging recorder; verify the audio/events correspond to the user actions in the previous step.

Step 3. Repeat Steps 1-2 using CONSOLE-1 to initiate the call.

Pass____ Fail____

5.1.1.4 Logging Trunking Talkgroup Call

1. DESCRIPTION

This test will demonstrate how the Archiving Interface Server (AIS) can be used to log trunking talkgroup call audio/events on a given talkgroup. The audio is archived in a vocoded format (IMBE for Trunking Talkgroup Calls).

SETUP

The AIS at MCC 7500 Console site affiliated to TALKGROUP 1.
RADIO-1 - TALKGROUP 1
RADIO-1 - Simulcast
CONSOLE-1 - TALKGROUP 1
CONSOLE-1 - CONSOLE SITE 1

VERSION #1.040

2. TEST

Step 1. Initiate a talkgroup call from RADIO-1 on TALKGROUP 1.

Step 2. Observe that the call events/audio are being sent to the logging system by the AIS.

Step 3. Using the playback station and logging recorder, verify the logged audio/events correspond to steps 1 and 2.

Step 4. Initiate a talkgroup call from CONSOLE-1 on TALKGROUP 1.

Step 5. Observe that the call events/audio are being sent to the logging system by the AIS.

Step 6. Using the playback station and logging recorder, verify the audio/events logged correspond to steps 4 and 5.

Pass____ Fail____

5.1.2 Fault Management Features

5.1.2.1 Analog Conventional Voice Channel Failure (MCC 7500 Systems only)

1. DESCRIPTION

This test verifies that the User Event Manager (UEM) event browser is able to capture information about various failures at the system and zone level. An analog conventional voice channel will be disabled and the alerts will be monitored.

SETUP

RADIO-1 - MA CALL
Conventional Channel Gateway (CCGW) 1 is in service and all four of its channels are operational.
CONSOLE-1 - MA CALL

VERSION #1.060

2. TEST

Step 1. Observe that the CCGW1 container is GREEN in the Unified Event Manager (UEM).

Step 2. Disable MA CALL on CCGW1.

Step 3. Observe the appropriate alert appears on the UEM Event Browser and that the CCGW1 container changes color.

Step 4. Observe that CONSOLE-1 is no longer able to contact RADIO-1.

Step 5. Disable the rest of the Analog Conventional Channels on CCGW1. Observe the appropriate alerts appear in the UEM.

Step 6. Bring each of the Channels on CCGW1 back into service.

Step 7. Observe the color for the CCGW1 container turns to GREEN (normal) in the UEM.

Step 8. Observe that CONSOLE-1 is now able to contact RADIO-1 on MA CALL.

Pass____ Fail____

5.1.2.2 Console PC - VPM Link Failure Reports to the Unified Event Manager (UEM)

1. DESCRIPTION

This test verifies that the Unified Event Manager (UEM) alarms view is able to capture information about various failures at the system and zone level.

This test simulates a Console PC to Voice Processing Module (VPM) link failure.

SETUP

RADIO-1 - TALKGROUP 1
CONSOLE-1 - TALKGROUP 1 (VPM Based console)

VERSION #1.030

2. TEST

Step 1. Initiate a call from RADIO-1 to CONSOLE-1 to verify communication.

Step 2. Remove the Ethernet cable from the VPM to the Console Site Ethernet Switch.

Step 3. Observe the UEM reports CommFailure alarms for the VPM.

Step 4. In addition, observe that CONSOLE-1 reports the link to the VPM as Down.

Step 5. Reconnect the VPM to the Console Site Ethernet Switch.

Step 6. Observe that UEM regains communication with the VPM and the Console PC to VPM link recovers.

Step 7. Initiate a call from RADIO-1 to CONSOLE-1 to verify communication.

Pass____ Fail____

5.1.2.3 Core Router Failure Reports to the Unified Event Manager (UEM)

1. DESCRIPTION

This test verifies that the Unified Event Manager (UEM) alarms view is able to capture information about various failures at the system and zone level.

A Core Router will be powered off to simulate a failure. The system health will be monitored on UEM.

SETUP

NMclient01 - UEM session up and running.

VERSION #1.060

2. TEST

Step 1. Verify that the Core Router to be tested displays without failures (normal) on UEM. The core router is contained in the specific subnet that it is physically collocated with in the network.

Step 2. Power down the Core Router.

Step 3. Observe that an alarm indicating a Core Router failure appears on the UEM alarms view.

Step 4. Restore power to the Core Router.

Step 5. Observe the changes to the alarm in UEM, indicating the Core Router is Enabling.

Step 6. Observe that alarm view updates in the UEM, indicating the Core Router is Enabled.

Pass____ Fail____

5.1.2.4 MCC 7500 Console Site Control Path Failure Monitored by Unified Event Manager

1. DESCRIPTION

This test verifies that the Unified Event Manager (UEM) is able to capture information about various failures at the system and zone level.

This test simulates a failure by removing the Console Site link(s). The alerts will be monitored at the Unified Event Manager.

SETUP

RADIO-1 TALKGROUP 1
RADIO-1 - SITE - Simulcast
CONSOLE-1 TALKGROUP 1
CONSOLE-1 - SITE - CONSimulcast

VERSION #1.020

2. TEST

Step 1. Initiate a Talkgroup call on TALKGROUP 1 by hitting the PTT on RADIO-1 and verify communication with CONSOLE-1.

Step 2. Remove the T1 or E1 cable(s) to the Console Site router(s) at CONSimulcast. Be certain to remove the T1 or E1 cable from both routers if redundant site links are being utilized.

Step 3. Observe the alert appears in the UEM indicating the Console Site Link has failed.

Step 4. Observe the color for the console site container turns from green (normal) to Black for loss of communications.

Step 5. Observe that CONSOLE-1 is no longer able to contact RADIO-1 on TALKGROUP 1.

Step 6. Connect the T1 or E1 cable(s) previously disconnected in step 2.

Step 7. Observe that the Console is now able to contact RADIO-1.

Step 8. Observe that the color for the site changes to Green (normal) at the UEM.

Pass____ Fail____

Station Power Amp Failure Reports to the Unified Event Manager (UEM)

1. DESCRIPTION

This test verifies that the Unified Event Manager (UEM) alarms view is able to capture information about various failures at the system and zone level.

A station will be keyed while the output is unloaded to simulate a power amp failure. The failures will be monitored on the UEM.

Note: For safety, either power down the station or TX Inhibit it before disconnecting or re-connecting the dummy load to prevent accidental keying of the station.

Note: This test should be done on a site with more than 2 channels. Failsoft will occur if the test is done on a 2 channel site.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 2
RADIO-2 - SITE - Simulcast
NMclient01 - UEM session up and running.

* All Radios should be "Site Locked"

VERSION #1.080

2. TEST

Step 1. Verify that the power amp of the station to be tested has no active alarms against it.

Step 2. Disconnect the dummy load/antenna from the station.

Step 3. Make several talkgroup calls using Radio-1 until the test station has been keyed.

Step 4. Observe that an alarm indicating a Power Amp failure appears on the UEM alarms view. For SmartX sites you will need to look at event view to see cause of alarm.

Step 5. Reconnect the dummy load/antenna disconnected in Step 3.

Step 6. In approximately 5 minutes, observe the changes to the alarm on the UEM, indicating the module is restored to service.

Pass____ Fail____

5.1.3 Integrated Voice and Data (IV&D)

5.1.3.1 Context Activation

1. DESCRIPTION

Context Activation covers the process a Radio uses to register for packet data service on the trunked system. For this test, the Radio is configured to initiate a context request with the system upon power-on.

SETUP

RADIO-1 - TALKGROUP 1 (Powered-off)

Note: RADIO-1 must be a XTS 5000 and must have data capabilities enabled in the network manager.

VERSION #1.080

2. TEST

Step 1. Power-on RADIO-1.

Step 2. Observer radio context activation and can be identified by the icon in the upper right-hand corner of the radio if equipped with a display.

Pass____ Fail____

5.1.3.2 Outbound Data Messaging

1. DESCRIPTION

The application server has the ability to send outbound messages to the MDT. The application server is connected to the IV&D network via an Ethernet connection. A data message is sent out through the data-capable base station that is connected to the RNC.

NOTE: This test assumes the availability of an application capable of sending text messages to a target IP.

SETUP

No prior setup is required.

VERSION #1.060

2. TEST

Step 1. From the application server on the LAN, specify the IP address of UNIT-1.

Step 2. Type "Hello" in the text field.

Step 3. Press the send button.

Step 4. Verify "Hello" is displayed on UNIT-1.

Pass____ Fail____

5.1.3.3 Context Reject - Radio Not Enabled for Data Service

1. DESCRIPTION

If a Radio is not enabled for data service in the SmartZone Manager, a Context Activation request from that Radio will be rejected. This test will demonstrate that a Radio that is not enabled for data service will not be allowed to register with the data system.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast

VERSION #1.040

2. TEST

Step 1. Open the Radio User record for RADIO-1. Verify that the radio record indicates that it is not enabled for data service.

Step 2. Verify that the "PPP Link Establishment icon" and the "Packet Data IP icon" on the Radio are not displayed. This indicates that the RADIO is not currently context activated with the system.

Step 3. Verify that the Digital Link Manager (DLM) Icon on the PC is red on the System Status area of the Taskbar. This indicates that a PPP link between the PC and the Radio is not present.

Step 4. Initiate a Context Activation Request from the Radio by starting the PPP (Point to Point Protocol) link assigned to the data service network connection from the PC.

Step 5. Verify that the context request for the Radio is unsuccessful.

Step 6. Verify that the "PPP Link Establishment icon" is visible and the "Packet Data IP icon" is not visible on RADIO-1's display.

Step 7. Verify that the DLM Icon on the PC is yellow in the System Status area of the Taskbar.

Pass____ Fail____

5.1.3.4 Context Deactivation - Initiated from the Network Manager

1. DESCRIPTION

Context deactivation covers the process used to cancel a currently active context. Context deactivation can be initiated either at the Radio or at the network manager. For this test, the context will be deactivated from the Network Manager. Once context deactivated, the Radio will be unable to use the packet data service. This test will be performed from a fixed location.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
(Mobile Data Terminal) MDT-1 - Connected
Note: RADIO-1 must be affiliated to the system and be context activated. Simulcast must be operating in wide area trunking, capable of supporting data service.

VERSION #1.050

2. TEST

Step 1. Verify that the "PPP Link Establishment icon" and the "Packet Data IP icon" on RADIO-1 are visible. This indicates that RADIO-1 is currently context activated with the system.

Step 2. Verify that the Data Link Manager (DLM) icon on MDT-1 is green displayed in the System Status area of the Taskbar. This indicates that a PPP (Point to Point Protocol) link between MDT-1 and RADIO-1 is present.

Step 3. From the Network Manager, open the Radio User record for RADIO-1 and change the "Data Enabled" parameter for the Radio to "No".

Step 4. Verify that RADIO-1 is context deactivated.

Step 5. Verify that the "PPP Link Establishment icon" is visible and the "Packet Data IP icon" on the Radio display is turned off.

Step 6. Verify that the DLM Icon on MDT-1 is now yellow in the System Status area of the Taskbar.

Pass____ Fail____

5.1.4 MCC 7500 Conventional Resources

5.1.4.1 Alert Tones

1. DESCRIPTION

Pre-defined alert tones can be transmitted on the selected Radio Resource to subscribers which can alert members of a channel / talkgroup to a particular event or signify to radio users special instructions are to follow. The Console has the ability to send an Alert-Tone signal on selected conventional or talkgroup resources.

SETUP

RADIO-1 - MA CALL
RADIO-2 - MA CALL
CONSOLE-1 - MA CALL

VERSION #1.080

2. TEST

Step 1. Select MA CALL on CONSOLE-1.

Step 2. Select Alert Tone 1 and depress the Alert Tone button.

Step 3. Verify that RADIO-1 and RADIO-2 hear Alert Tone 1.

Step 4. Repeat Steps 2-3 for Alert Tone 2 and 3.

Pass____ Fail____

5.1.4.2 Channel Marker - Conventional

1. DESCRIPTION

A Channel Marker is a distinct, short duration, audible tone over radio and Console speakers. The tone is initiated and cancelled by a console operator.

The tone can be initiated only for the talkgroups or conventional channels. On initiation, it is generated periodically when there is no voice activity. The tone can be used for various purposes. The primary purpose of the tone is to inform radio users that the conventional channel or the trunked talkgroup is currently involved in a high priority situation and they should stay off the channel unless they are involved in the high priority situation. The tone also informs the users that a console operator is actively monitoring the talkgroup.

Note that the Channel Marker tone will only start when there is no voice activity for the selected Talkgroup or conventional channel. The channel Marker tone is sent in a current transmission mode of the Console user.

SETUP

RADIO-1 MA CALL
RADIO-2 MA CALL
CONSOLE-1 - MA CALL
CONSOLE-2 - MA CALL

VERSION #1.100

2. TEST

Step 1. Initiate a Channel Marker tone on MA CALL from CONSOLE-1.

Step 2. Verify RADIO-1 and RADIO-2 can monitor the Channel Marker tone on MA CALL.

Step 3. Verify CONSOLE-1 and CONSOLE-2 also monitor the Channel Marker tone on MA CALL.

Step 4. Initiate a call from RADIO-1 and continue to key longer than the preset Channel Marker tone period for MA CALL.

Step 5. Verify while RADIO-1 is keyed, the Channel Marker tone is suppressed.

Step 6. Verify after RADIO-1 de-keys, the periodic Channel Marker tone continues to be transmitted on MA CALL.

Step 7. Cancel the Channel Marker on MA CALL from CONSOLE-1.

Step 8. Verify the Channel Marker is no longer monitored on MA CALL.

Pass____ Fail____

5.1.4.3 Console Priority

1. DESCRIPTION

Console Operator Positions have ultimate control of transmitted audio on an assigned resource. The Console Position has the capability to take control of an assigned voice channel for a channel/talkgroup call so that the operator's audio overrides any subscriber audio. Console priority is a feature that enables dispatchers to gain immediate access to an assigned voice channel so that a central point of audio control exists.

SETUP

RADIO-1 - MA CALL
RADIO-2 - MA CALL
CONSOLE-1 - MA CALL

VERSION #1.050

2. TEST

Step 1. Initiate a Talkgroup call from RADIO-1 on MA CALL. Keep this call in progress until the test has completed.

Step 2. Observe that RADIO-2 receives the call.

Step 3. While the call is in progress, key up CONSOLE-1 on MA CALL.

Step 4. Observe that RADIO-2 is now receiving audio from CONSOLE-1 on MA CALL.

Step 5. De-key CONSOLE-1.

Step 6. Verify RADIO-2 now receives RADIO-1 audio.

Step 7. End the MA CALL call from RADIO-1.

Pass____ Fail____

5.1.4.4 Conventional Call

1. DESCRIPTION

Dispatchers with Conventional Call capability will be able to communicate with other members of the same channel. When a Conventional Call is initiated from a subscriber unit, the call is indicated on each dispatch operator position that has a channel control resource associated with the unit's channel.

SETUP

RADIO-1 - MA CALL
RADIO-2 - MA TAC 1
RADIO-3 - MA CALL
RADIO-4 - MA TAC 1
CONSOLE-1 - MA CALL

2. TEST

Step 1. Initiate a call from CONSOLE-1 on MA CALL.

Step 2. Observe that RADIO-1 and RADIO-3 will be able to monitor the call. End the call from CONSOLE-1 and have either radio respond to the call.

Step 3. Observe that all consoles with MA CALL can monitor both sides of the conversation.

Step 4. Initiate a call from CONSOLE-1 on MA TAC 1.

Step 5. Observe that RADIO-2 and RADIO-4 will be able to monitor the call. End the call on CONSOLE-1 and have either radio respond to the call.

Step 6. Observe that all consoles with MA TAC 1 can monitor both sides of the conversation.

VERSION #1.030

Pass____ Fail____

5.1.4.5 ID Stacking

1. DESCRIPTION

During normal call operation radio IDs are displayed in the resource window for a particular resource. These IDs are saved in a "Stack" and can be viewed to determine which radios made the previous calls. The stack size can be up to 10 IDs. This test is applicable to the Digital Conventional feature.

SETUP

RADIO-1 - MA CALL
RADIO-2 - MA CALL
RADIO-3 - MA CALL
CONSOLE-1 - MA CALL

VERSION #1.030

2. TEST

Step 1. At CONSOLE-1 view the MA CALL Resource Window.

Step 2. Initiate calls from RADIO-1, RADIO-2 then RADIO-3 on MA CALL.

Step 3. Scroll through the stack to see that the radio IDs are displayed in the order received.

Step 4. Repeat steps 1-3 for a sample of the remaining OPs as needed.

Pass____ Fail____

5.1.4.6 Multi-Select Operation

1. DESCRIPTION

Multi-Select (Msel) allows the console operator to group a number of channels/talkgroups together such that when the general transmit bar is depressed, all of the multi-selected channels/talkgroups will transmit at the same time with the same information. Multi-Select is one way communication call. If a radio user responds to a Multi-Select call the talkgroup the user is affiliated to will be the only one to hear the call. There is no super-group formed, so radio communication is still at the single talkgroup level. Multi-Select is utilized to send an APB to several channels/talkgroups. A Multi-Select has a limit of twenty (20) trunking/conventional resources

SETUP

RADIO-1 - MA CALL
RADIO-2 - MA TAC 1
CONSOLE-1 - MA CALL, MA TAC 1

VERSION #1.040

2. TEST

Step 1. From CONSOLE-1, create an Msel group with MA CALL and MA TAC 1.

Step 2. Transmit on the Msel using the Msel instant transmit button.

Step 3. Verify that RADIO-1 and RADIO-2 hear the call.

Step 4. Initiate a call with RADIO-1.

Step 5. Verify the call is heard on CONSOLE-1 but not on RADIO-2.

Step 6. Initiate a call with RADIO-2.

Step 7. Verify the call is heard on CONSOLE-1 but not on RADIO-1.

Step 8. On CONSOLE-1 dissolve the Msel.

Pass____ Fail____

5.1.4.7 Patch Operation - Conventional

1. DESCRIPTION

The Patch feature allows the dispatcher to merge several resources together enabling them to participate in a single conversation. This can be used for temporarily merging two or more channels together to act as one larger group. In a patch group, the members can receive calls from the console and they can transmit to all other members of the patch group.

SETUP

RADIO-1 - MA CALL
RADIO-2 - MA TAC 1
CONSOLE-1 - MA CALL and MA TAC 1

VERSION #1.030

2. TEST

Step 1. Using CONSOLE-1 create a patch between MA CALL and MA TAC 1.

Step 2. Initiate a patch call from CONSOLE-1.

Step 3. Verify RADIO-1 and RADIO-2 can monitor the call.

Step 4. Initiate several calls between RADIO-1 and RADIO-2 and verify successful communication.

Step 5. Dissolve the patch created in step 1.

Pass____ Fail____

5.1.4.8 Status Request

1. DESCRIPTION

Statuses are used to indicate the Radio operator's operational state (e.g. off duty). The information that will be displayed includes the radio alias, hour and minute time stamp, event state and the customer entered translation for the specific status. The Status Request service is supported from a Console using a Conventional channel. The Console will be updated when the Console initiates a Status Request from the resource window. There are sixteen unique statuses in the radio. Each status can have a sixty character text alias in the console data base. This test can be run using Digital Conventional or MDC1200 Channels.

SETUP

RADIO-1 - MA CALL
CONSOLE-1 - MA CALL

VERSION #1.060

2. TEST

Step 1. Initiate a status message from RADIO-1.

Step 2. Verify CONSOLE-1 displays the proper Status text and the operator is audibly alerted to the status.

Step 3. Using CONSOLE-1 choose the Status Request button on MA CALL. Select RADIO-1 from the list and send the request.

Step 4. Verify the status text is displayed at CONSOLE-1 for the last status of RADIO-1.

Pass____ Fail____

5.1.5 MCC 7500 Trunked Resources

5.1.5.1 Activity Log

1. DESCRIPTION

The Console activity log will show all traffic for the resource assigned to that console to include the time, radio alias, TG, PTT ID and Emergency Call.

The dispatcher has the capability of selecting a logged call within in the "Activity Log Window" for instant transmit on the corresponding logged resource.

This activity log can be logged to a text file for archival purposes.

SETUP

RADIO-1 – TALKGROUP 1
RADIO-2 – TALKGROUP 2
RADIO-3 – TALKGROUP 3
RADIO-4 – TALKGROUP 4
CONSOLE-1 – TALKGROUP 1, TALKGROUP 2, TALKGROUP 3, TALKGROUP 4

VERSION #1.060

2. TEST

Step 1. On CONSOLE-1 select the "Show Activity Log" button on the tool bar to open the Activity Log Window.

Step 2. Initiate calls on RADIO-1, RADIO-2, RADIO-3 and RADIO-4 to log call information and verify calls are displayed in the activity log window.

Step 3. Select a logged call in the Activity Log Window and verify that the Channel Control Window (CCW) at the top of the Activity log window changes to the corresponding resource. Verify the dispatcher is capable of responding via the instant transmit button.

Step 4. Open the text file created by the Activity Log and verify call traffic has been archived to the document file.

Pass____ Fail____

5.1.5.2 Call Alert

1. DESCRIPTION

Call Alert Page allows a subscriber/dispatcher to selectively alert another radio unit. The initiating subscriber/console will receive notification as to whether or not the call alert was received. Units receiving a Call Alert will sound an alert tone and show a visual alert indication. The display will also show the individual ID of the initiating subscriber/console unit.

SETUP

RADIO-1 - TALKGROUP 1
CONSOLE-1 - TALKGROUP 1

VERSION #1.080

2. TEST

Step 1. Using CONSOLE-1, select the call alert button in the "Private Call" resource window.

Step 2. Enter the ID of RADIO-1 and send the call alert to RADIO-1.

Step 3. Verify that RADIO-1 receives the alert and that the ID of the console is shown.

Step 4. Turn off RADIO-1.

Step 5. Using CONSOLE-1, send the call alert to RADIO-1 again.

Step 6. Verify that after trying to page RADIO-1, the console displays "Can not send call alert - target not found" in the summary list.

Pass____ Fail____

5.1.5.3 Channel Marker

1. DESCRIPTION

A Channel Marker is a distinct, short duration, audible tone over radio and Console speakers. The tone is initiated and cancelled by a console operator.

The tone can be initiated only for the talkgroups or conventional channels. On initiation, it is generated periodically when there is no voice activity. The tone can be used for various purposes. The primary purpose of the tone is to inform radio users that the conventional channel or the trunked talkgroup is currently involved in a high priority situation and they should stay off the channel unless they are involved in the high priority situation. The tone also informs the users that a console operator is actively monitoring the talkgroup.

Note that the Channel Marker tone will only start when there is no voice activity for the selected Talkgroup or conventional channel. The channel Marker tone is sent in a current transmission mode of the Console user.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-2 - TALKGROUP 1
CONSOLE-1 - TALKGROUP 1
CONSOLE-2 - TALKGROUP 1

VERSION #1.040

2. TEST

Step 1. Initiate a Channel Marker tone on TALKGROUP 1 from CONSOLE-1.

Step 2. Verify RADIO-1 and RADIO-2 can monitor the Channel Marker tone on TALKGROUP 1.

Step 3. Verify CONSOLE-1 and CONSOLE-2 also monitor the Channel Marker tone on TALKGROUP 1.

Step 4. Initiate a call from RADIO-1 and continue to key longer than the preset Channel Marker tone period for TALKGROUP 1.

Step 5. Verify while RADIO-1 is keyed, the Channel Marker tone is suppressed.

Step 6. Verify after RADIO-1 de-keys, the periodic Channel Marker tone continues to be transmitted on TALKGROUP 1.

Step 7. Cancel the Channel Marker on TALKGROUP 1 from CONSOLE-1.

Step 8. Verify the Channel Marker is no longer monitored on TALKGROUP 1.

Pass____ Fail____

5.1.5.4 Console Initiated Private Call

1. DESCRIPTION

Private Conversation is a selective calling feature which allows a dispatcher or radio user to carry on one-to-one conversation that is heard only by the two parties involved. Subscriber units receiving a private call will sound an alert tone. As with other call types, Private Calls operate across sites as well as within the same site.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-2 - TALKGROUP 1
CONSOLE-1 - TALKGROUP 1

VERSION #1.060

2. TEST

Step 1. Using CONSOLE-1, select the "PRIVATE-CALL" tile and click the Private Call function.

Step 2. Select the unit to be Private Called, in this case RADIO-1. (or select the numeric keypad and enter the Unit ID to be Private Called.)

Step 3. Click the Send button.

Step 4. Answer the Private Call with RADIO-1 and respond to the console.

Step 5. Verify RADIO-2 does not hear the private conversation.

Step 6. After completing the Private Call, return to the normal talkgroup mode.

Pass____ Fail____

5.1.5.5 Console Priority

1. DESCRIPTION

Console Operator Positions have ultimate control of transmitted audio on an assigned voice channel resource. The Console Position has the capability to take control of an assigned voice channel for a talkgroup call so that the operator's audio overrides any subscriber audio. Console priority is a feature that enables dispatchers to gain immediate access to an assigned voice channel so that a central point of audio control exists.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-2 - TALKGROUP 1
CONSOLE-1 - TALKGROUP 1

VERSION #1.120

2. TEST

Step 1. Initiate a Talkgroup call from RADIO-1 on TALKGROUP 1. Keep this call in progress until the test has completed.

Step 2. Observe that RADIO-2 receives the call.

Step 3. While the call is in progress, key up CONSOLE-1 on TALKGROUP 1.

Step 4. Observe that RADIO-2 is now receiving audio from CONSOLE-1 on TALKGROUP 1.

Step 5. De-key CONSOLE-1.

Step 6. Verify RADIO-2 now receives RADIO-1 audio.

Step 7. End the TALKGROUP 1 call from RADIO-1.

Pass____ Fail____

5.1.5.6 Emergency Alarm and Call Display Description

1. DESCRIPTION

Users in life threatening situations can use the emergency button on the radio to send an audible alarm and a visual alarm signal to a console operator in order to request immediate system access to a voice channel for an emergency call.

An emergency alarm begins after the radio user presses the radio's emergency button. Pressing the emergency button places the radio in "emergency mode". To begin an emergency call, the radio user must press the radio's PTT button while in "emergency mode." The assigned voice channel will be dedicated to the emergency caller's talkgroup for an extended period of time, equal to the Message Hang Time plus the Emergency Hang Time. As with other call types, emergency calls can operate across sites as well as within the same site.

SETUP

RADIO-1 - TALKGROUP 1
CONSOLE-1 - TALKGROUP 1
CONSOLE-2 - TALKGROUP 1

VERSION #1.060

2. TEST

Step 1. Initiate an Emergency Alarm from RADIO-1.

Step 2. Observe the Emergency from RADIO-1 is received at CONSOLE-1 for TALKGROUP 1.

Step 3. Acknowledge the Emergency at the operator position. Verify CONSOLE-2 receives notification that the call has been acknowledged.

Step 4. Initiate a call with RADIO-1 to initiate an Emergency call.

Step 5. Observe CONSOLE-1 and CONSOLE-2 can monitor RADIO-1.

Step 6. Clear the Emergency from CONSOLE-1 on TALKGROUP 1.

Step 7. End the Emergency Alarm from RADIO-1.

Pass____ Fail____

5.1.5.7 Instant Transmit

1. DESCRIPTION

The instant transmit switch provides immediate operator access to a channel, independent of its select status (selected or unselected). It provides priority over other dispatcher transmit bars or optional footswitches.

SETUP

RADIO-1 - TALKGROUP 1
CONSOLE-1 – TALKGROUP 1 (Selected), TALKGROUP 2 (Unselect mode)

VERSION #1.090

2. TEST

Step 1. Using CONSOLE-1, press the Instant Transmit button on TALKGROUP 1.

Step 2. Verify that the Transmit indicator is lit.

Step 3. Verify RADIO-1 can monitor and respond to the call on TALKGROUP 1.

Step 4. On RADIO-1 change to TALKGROUP 2.

Step 5. Using CONSOLE-1, press the Instant Transmit button on the TALKGROUP 2 radio resource.

Step 6. Verify RADIO-1 can monitor and respond to the call on TALKGROUP 2.

Pass____ Fail____

5.1.5.8 Multi-Select Operation

1. DESCRIPTION

Multi-Select (Msel) allows the console operator to group a number of channels/talkgroups together such that when the general transmit bar is depressed, all of the multi-selected channels/talkgroups will transmit at the same time with the same information. Multi-Select is one way communication call. If a radio user responds to a Multi-Select call the talkgroup the user is affiliated to will be the only one to hear the call. There is no super-group formed, so radio communication is still at the single talkgroup level. Multi-Select is utilized to send an APB to several channels/talkgroups. A Multi-Select has a limit of twenty (20) trunking/conventional resources

SETUP

RADIO-1 - TALKGROUP 1
RADIO-2 - TALKGROUP 2
CONSOLE-1 - TALKGROUP 1, TALKGROUP 2

VERSION #1.070

2. TEST

Step 1. From CONSOLE-1, create an Msel group with TALKGROUP 1 and TALKGROUP 2.

Step 2. Transmit on the Msel using the Msel instant transmit button.

Step 3. Verify that RADIO-1 and RADIO-2 hear the call.

Step 4. Initiate a call with RADIO-1.

Step 5. Verify the call is heard on CONSOLE-1 but not on RADIO-2.

Step 6. Initiate a call with RADIO-2.

Step 7. Verify the call is heard on CONSOLE-1 but not on RADIO-1.

Step 8. On CONSOLE-1 dissolve the Msel.

Pass____ Fail____

5.1.5.9 Multigroup Call

1. DESCRIPTION

This trunking feature allows an equipped console operator position to transmit an announcement to several different talkgroups simultaneously. As with Talkgroup Calls, multigroup calls operate across sites as well as within the same site.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-2 - TALKGROUP 2
RADIO-3 - RANDOM
CONSOLE-1 - ATG 1

Note: TALKGROUP 1 and TALKGROUP 2 are members of ATG 1. RANDOM is any talkgroup not a member of ATG 1.

VERSION #1.130

2. TEST

Step 1. Using CONSOLE-1, select the ATG 1 resource.

Step 2. Initiate the Multigroup Call from CONSOLE-1.

Step 3. Observe that RADIO-1 and RADIO-2 receive the Multigroup Call.

Step 4. Verify that RADIO-3 does not receive the Multigroup Call because it is not a member of ATG 1.

Step 5. Answer the Multigroup Call using RADIO-1 and observe CONSOLE-1 receives the response.

Step 6. Verify that if the call is answered within the repeater hang time, the console will receive the call on the ATG 1 resource tile, otherwise the console will receive the call on the TALKGROUP 1 tile.

Step 7. Verify that if the call is answered within the repeater hang time, RADIO-2 will monitor the call.

Pass____ Fail____

5.1.5.10 PTT Unit ID/Alias Display

1. DESCRIPTION

Console operator positions contain various resources such as talkgroup, multigroup, Private Call which enables the dispatcher to communicate with the subscriber units. If activity occurs on one of these operator position resources, the unit ID or associated alias of the initiating radio appears at the console resource.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-2 - TALKGROUP 1
CONSOLE-1 - TALKGROUP 1
CONSOLE-2 - TALKGROUP 1

VERSION #1.030

2. TEST

Step 1. Select the resource for TALKGROUP 1 on CONSOLE-1.

Step 2. Initiate a call on TALKGROUP 1 from RADIO-2 and observe that the alias is seen at CONSOLE-1 in the resource window as well as in the Activity Log window.

Step 3. Initiate a call from RADIO-1 and observe that the alias of RADIO-1 is seen at CONSOLE-1 in the resource window as well as in the Activity Log window.

Step 4. Modify RADIO-2's alias. Make sure to give enough time for the alias change to propagate to the Zone Controller.

Step 5. Initiate a call from RADIO-2 and observe the new alias of RADIO-2 is seen at CONSOLE-1 in the list in the resource window as well as in the Activity Log window.

Step 6. Return RADIO-2's alias to its original state.

Pass____ Fail____

5.1.5.11 Secure/Clear Cross-Mode Indication

1. DESCRIPTION

This test validates the ability of the console to show a visual indication of a Secure and Clear mode mismatch during the following conditions:

1. Talkgroup on the Console is in secure transmit mode but receiving clear audio.
2. Talkgroup on the Console is in clear transmit mode but receiving secure audio.

SETUP

RADIO-1 - TALKGROUP 1 (Secure TX mode)
CONSOLE-1 - TALKGROUP 1 (Secure TX mode)

VERSION #1.050

2. TEST

Step 1. Initiate a secure call on RADIO-1.

Step 2. Verify CONSOLE-1 is able to receive audio from RADIO-1.

Step 3. Place RADIO-1 in clear TX mode.

Step 4. Initiate a call on RADIO-1.

Step 5. Verify CONSOLE-1 is able to receive audio from RADIO-1 and displays a secure mode mismatch indication.

Step 6. Place RADIO-1 in secure transmit mode and place CONSOLE-1 in clear transmit mode.

Step 7. Initiate a secure call on RADIO-1.

Step 8. Verify CONSOLE-1 is able to receive audio from RADIO-1 and displays a secure Cross-Mode Indication.

Pass____ Fail____

5.1.5.12 Talkgroup Call - Secure

1. DESCRIPTION

Digital encryption is used so only properly equipped and configured subscribers can monitor the conversation. A "Key" is used to encrypt the transmit audio. Only radios and Consoles with the same "Key" can decrypt the audio and listen to it.

SETUP

RADIO-1 - TALKGROUP 1 (Secure TX Mode)
RADIO-2 - TALKGROUP 2 (Secure TX Mode)
RADIO-3 - TALKGROUP 2 (No Keys)
RADIO-4 - TALKGROUP 1 (Clear TX Mode with Keys loaded)
CONSOLE-1 - TALKGROUP 1 and TALKGROUP 2 (Secure TX Mode)

VERSION #1.120

2. TEST

Step 1. Initiate a wide area secure call from CONSOLE-1 on TALKGROUP 1.

Step 2. Verify RADIO-1 and RADIO-4 can monitor and respond to the secure call.

Step 3. Initiate a wide area secure call from CONSOLE-1 on TALKGROUP 2.

Step 4. Verify that RADIO-2 can monitor and respond to the secure call. Note that RADIO-3 cannot monitor the call.

Pass____ Fail____

5.1.5.13 Talkgroup Patch

1. DESCRIPTION

Talkgroup Patch allows a dispatcher to merge several talkgroups together on one voice channel to participate in a single conversation. This can be used for situations involving two or more talkgroups that need to communicate with each other.

Using the Patch feature, the console operator can talk and listen to all of the selected talkgroups grouped; in addition, the members of the individual talkgroups can also talk or listen to members of other talkgroups. Patched talkgroups can communicate with the console dispatcher and other members of different talkgroups because of the "supergroup" nature of the Patch feature.

NOTE : If "secure" and "clear" resources are patched together, one repeater for each mode may be assigned per site.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-2 - TALKGROUP 2
RADIO-3 - TALKGROUP 1
RADIO-4 - TALKGROUP 2
CONSOLE-1 - TALKGROUP 1 and TALKGROUP 2

Note: All 4 Radios must have the same home zone.

VERSION #1.100

2. TEST

Step 1. Using CONSOLE-1 create a patch between TALKGROUP 1 and TALKGROUP 2.

Step 2. Initiate a patch call from CONSOLE-1.

Step 3. Verify RADIO-1, RADIO-2, RADIO-3, and RADIO-4 can monitor the call.

Step 4. Initiate several calls between the radios and verify successful communication.

Step 5. Dissolve the patch created in step 1.

Pass____ Fail____

5.1.5.14 Talkgroup Patch - Secure

1. DESCRIPTION

Talkgroup Patch allows a dispatcher to merge several talkgroups together on one voice channel to participate in a single conversation. This can be used for situations involving two or more talkgroups that need to communicate with each other. Using the Patch feature, the console operator can talk and listen to all of the selected talkgroups grouped; in addition, the members of the individual talkgroups can also talk or listen to members of other talkgroups. Patched talkgroups can communicate with the console dispatcher and other members of different talkgroups because of the "supergroup" nature of the Patch feature.

SETUP

RADIO-1 - TALKGROUP 1 (Secure TX Mode)
RADIO-2 - TALKGROUP 2 (Secure TX Mode)
RADIO-3 - TALKGROUP 1 (No secure keys loaded)
RADIO-4 - TALKGROUP 2 (Clear TX Mode with keys loaded)
CONSOLE-1 - TALKGROUP 1 and TALKGROUP 2 (Secure TX Mode)

VERSION #1.090

2. TEST

Step 1. Using CONSOLE-1 create a secure patch between TALKGROUP 1 and TALKGROUP 2.

Step 2. Initiate a patch call from CONSOLE-1.

Step 3. Verify RADIO-1, RADIO-2 and RADIO-4 can monitor the call.

Step 4. Initiate a talkgroup call on TALKGROUP 1 from RADIO-1.

Step 5. Observe that all radios are able to hear RADIO-1 except RADIO-3.

Step 6. Dissolve the patch.

Pass____ Fail____

5.1.5.15 Talkgroup Selection and Call

1. DESCRIPTION

The Talkgroup Call is the primary level of organization for communications on a trunked radio system. Dispatchers with Talkgroup Call capability will be able to communicate with other members of the same talkgroup. This provides the effect of an assigned channel down to the talkgroup level. When a Talkgroup Call is initiated from a subscriber unit, the call is indicated on each dispatch operator position that has a channel control resource associated with the unit's channel/talkgroup.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-2 - TALKGROUP 2
RADIO-3 - TALKGROUP 1
RADIO-4 - TALKGROUP 2
CONSOLE-1 - TALKGROUP 1
CONSOLE-2 - TALKGROUP 2

VERSION #1.120

2. TEST

Step 1. Initiate a wide area call from CONSOLE-1 on TALKGROUP 1.

Step 2. Observe that RADIO-1 and RADIO-3 will be able to monitor the call. Dekey the console and have either radio respond to the call.

Step 3. Observe that all consoles with TALKGROUP 1 can monitor both sides of the conversation.

Step 4. Initiate a wide area call from CONSOLE-2 on TALKGROUP 2.

Step 5. Observe that RADIO-2 and RADIO-4 will be able to monitor the call. Dekey the console and have either radio respond to the call.

Step 6. Observe that all consoles with TALKGROUP 2 can monitor both sides of the conversation.

Pass____ Fail____

5.1.6 MOSCAD Fault Management System

5.1.6.1 Alarm Processing - Acknowledged Alarm

1. DESCRIPTION

This segment of the test verifies that the bi-state site alarms are processed and communicated to the MOSCAD server. The alarms can originate from a device with "hard wired" physical dry contact interfacing or from a device connected to the MOSCAD CPU by means of an RS232 interface.

SETUP

VERSION #1.030

2. TEST

Step 1. Create an alarm condition by simulating an alarm on a device in the system or shorting/opening a status input to any MOSCAD status input module in the system. Navigate to the lowest level screen that depicts the highest degree of alarm detail.

Step 2. Verify that the colored status bullet for the associated alarm on the server is blinking red and that the "state" text is red and is displayed for the correct alarm point and site.

Step 3. If speakers are present, verify that an audible indication is heard at the server.

Step 4. Verify that the alarm displays in red text on the Alarm Summary window.

Step 5. Click with the mouse on the "acknowledge" button. Verify that the audible indication is silenced.

Step 6. Verify that the text on the alarm summary window of the server changes from red to black.

Step 7. Verify that the colored status bullet for the associated alarm on the server remains red but stops blinking.

Step 8. Return the alarm point to the normal condition. Verify that the colored status bullet for the associated alarm returns to green.

Step 9. Verify that the text is removed from the alarm summary window.

Pass____ Fail____

5.1.6.2 GCP 8000 MultiSite Controller - Ethernet Communications Failure Detection

1. DESCRIPTION

The MOSCAD system will interface to the GCP 8000 via the network hub or switch. Select alarm messages are then converted to native MOSCAD data format for transmission to the MOSCAD alarm Server.

SETUP

No prior setup is required.

VERSION #1.000

2. TEST

Step 1. Choose the site to perform test.

Step 2. Verify that there are no current alarms for the chosen primary or redundant GCP 8000.

Step 3. Disconnect one of the GCP 8000s from the Ethernet network.

Step 4. Verify that the graphic user interface indicates that the primary GCP has failed SNMP communications. Note that this failure detection can take up to 10 minutes to be displayed.

Step 5. Acknowledge the alarm on a MOSCAD server or client.

Step 6. Re-connect the Ethernet cable previously removed.

Step 7. Verify the communications alarm clears.

Pass____ Fail____

5.1.6.3 GCP 8000 MultiSite Controller - Site Failsoft

1. DESCRIPTION

The MOSCAD system will interface to the GCP 8000 via the network switch. Select alarm messages are then converted to native MOSCAD data format for transmission to the MOSCAD alarm Server.

SETUP

No prior setup is required.

VERSION #1.030

2. TEST

Step 1. Choose the site to perform test.

Step 2. Verify that there are no current alarms for the chosen GCP 8000 on the MOSCAD server and client(s).

Step 3. From the UEM select the Simulcast site to be tested, right click the site select View Devices, then select "Issue Command, set the Site to "Site Failsoft".

Step 4. Verify that a site failsoft alarm is received at the MOSCAD server and clients.

Step 5. Acknowledge the alarm on either the MOSCAD server or client.

Step 6. Return the site from failsoft.

Step 7. Verify that the site controller returns to normal.

Pass____ Fail____

5.1.6.4 Physical Inputs/Outputs - Analog Inputs

1. DESCRIPTION

The purpose of this section is to verify that the physical inputs and outputs that interface to the MOSCAD I/O modules are properly processed by the MOSCAD system. Analog inputs can be tested by comparing GUI needle deflection on-screen (full scale, half scale, 2/3 scale, etc)

Analog values can only been seen on the MOSCAD alarm server and clients.

SETUP

VERSION #1.030

2. TEST

Step 1. Choose the site to perform the test.

Step 2. At the MOSCAD server or client, select the Analog Input icon from the testing site overview screen.

Step 3. Using a MOSCAD test board, manipulate the analog input voltage by moving the potentiometer to ¼, ½, or ¾ of the full range.

Step 4. Verify that the needle deflection of the MOSCAD alarm manager matches, with reasonable accuracy, to that of the potentiometer.

Pass____ Fail____

5.1.6.5 Report Generator

1. DESCRIPTION

The Report Generator is used as a stand-alone or a networked application to log and report alarms that are generated within the Wonderware Intouch database. Alarms and Acknowledgements can be logged and stored according to the time, site, or equipment at which the alarm originated, and the detailed summary of filtered events can then be forwarded to a printer. Report Generator is capable of Auto Archiving on a monthly basis or at every 150,000 events, whichever occurs first, and it includes utilities to both compact and repair the alarm database.

SETUP

No prior setup is required.

VERSION #1.040

2. TEST

Step 1. Minimize the Wonderware Intouch software and select the Report Generator icon from the Windows desktop.

Step 2. Select the "Show Report" button shown in the application.

Step 3. Verify that the present date is displayed as well as any past alarms for which the Report Generator is configured.

Step 4. Create several alarm conditions (typically 2 or 3) by simulating alarms on devices in the system or by shorting/opening a status input to any MOSCAD status input module in the system.

Step 5. Verify that the alarms are displayed on the Wonderware Intouch alarm summary screen.

Step 6. Verify that the alarms are displayed on the Report Generator alarm history report.

Pass____ Fail____

5.1.6.6 Screen Navigation

1. DESCRIPTION

MOSCAD alarming tests shall be conducted from the MOSCAD server and clients if applicable. The alarms demonstrated are to be made on the actual equipment or punch block interface, with an exception made for cases where it is not practical to create an actual alarm. The following will provide a brief introduction and description of the main display screens encountered when navigating the MOSCAD GUI (Graphic User Interface).

SETUP

No prior setup is required.

VERSION #1.080

2. TEST

Step 1. Login and Password Screen -
This is the first screen displayed after a system startup. It allows a user with the proper login and password to access the MOSCAD alarm system. Login to MOSCAD using the appropriate user name and password.

Step 2. System Overview Screen -
The "System Overview" screen contains site names adjacent to color status pushpins. Details of a particular site can be viewed by selecting the site name pushpin of interest. Depending on alarm status, the color bullet will flash

Step 3. Alarm Summary Screen -
Proceed to the "Alarm Summary" screen from the "System Overview" screen. The "Alarm Summary" screen provides a text display of all alarms currently in the system. On this screen, you can choose between alarm summary and alarm history by selecting the "Alarm Summary / Alarm History" button. Also, the display can be filtered to show alarms based on site name or acknowledgement status.

Step 4. Comm Screen -
From the "Alarm Summary" screen access the "Site Comm" screen. The "Site Comm" screen displays a combined communication status for each site. To view all the SDM3000s within a site, select the icon next to the site comm. Should the communications path between the IP Gateway and any SDM3000 in the system be interrupted, it will be indicated by an alarm present on this screen.

Step 5. Device Monitoring
From the "System Overview" screen, navigate to each site monitored by MOSCAD in the system. Once a particular site pushpin has been selected, a site overview screen will appear that indicates the types and quantities of devices monitored by MOSCAD at that site.

Pass____ Fail____

5.1.6.7 TRAK GPS - GPS Fault

1. DESCRIPTION

The MOSCAD system connects to a TRAK 9100 GPS Standard via the RS-232 port 9 pin D connector. This interface requires a dedicated MOSCAD RS-232 port. The MOSCAD will periodically solicit the TRAK for its status and response messages are sent back to the MOSCAD SDM3000. New alarm messages, with respect to the last received status held in the SDM3000, are then converted to native MOSCAD data format for transmission to the MOSCAD Server. Alarm messages are also sent as SNMP traps from the SDM3000's IP Interface to the Unified Event Manager (UEM) application.

SETUP

NMclient01 - UEM session up and running.

VERSION #1.040

2. TEST

Step 1. Choose the site to perform the test.

Step 2. Verify there are no current alarms for the chosen TRAK GPS on the MOSCAD server and UEM active alarms view.

Step 3. Disconnect the antenna cable from the TRAK GPS.

Step 4. Verify that the alarm is received at the MOSCAD server and/or client.

Step 5. Acknowledge the alarm on either the MOSCAD server or client.

Step 6. Reconnect the antenna cable to the TRAK GPS standard.

Step 7. Verify that the TRAK GPS status returns to normal.

Pass____ Fail____

5.1.6.8 TRAK GPS - Power Supply Fault

1. DESCRIPTION

The MOSCAD system connects to a TRAK 9100 GPS Standard via the RS-232 port 9 pin D connector. This interface requires a dedicated MOSCAD SDM3000 RS-232 port. The MOSCAD will periodically solicit the TRAK for its status and response messages are sent back to the MOSCAD SDM3000. New alarm messages, with respect to the last received status held in the SDM3000, are then converted to native MOSCAD data format for transmission to the MOSCAD alarm Server. Alarm messages are also sent as SNMP traps from the SDM3000's IP Interface to the Unified Event Manager (UEM) application.

SETUP

NMclient01 - UEM session up and running.

VERSION #1.040

2. TEST

Step 1. Choose the site to perform the test.

Step 2. Verify there are no current alarms for the chosen TRAK GPS on the InTouch and UEM active alarms view.

Step 3. Disconnect one of the power supply cables from the rear of the TRAK GPS.

Step 4. Verify that the alarm is received on the alarm managers.

Step 5. Acknowledge the alarm on the MOSCAD server or client.

Step 6. Reconnect the power supply cable to the rear of the TRAK GPS.

Step 7. Verify that the TRAK GPS power status returns to normal.

Pass____ Fail____

5.1.7 Network Security Tests

5.1.7.1 Intrusion Detection - Port Scan

1. DESCRIPTION

The network is configured with an Intrusion Detection Sensor. This test will simulate a port scan of a host within the Radio Network Interface (RNI).

Nmap ("Network Mapper") is a free open source utility for network exploration or security auditing. It is designed to rapidly scan large networks, although it works fine against single hosts. Nmap uses raw IP packets in novel ways to determine what hosts are available on the network, what services (application name and version) they are offering, what operating system (and OS version) they are running, what type of packet filters/firewalls are in use, and dozens of other characteristics. Nmap runs on most types of computers and both console and graphical versions are available. Nmap is free software, available with full source code under the terms of the GNU GPL.

SETUP

This test will require a machine running Linux and loaded with the Nmap port scanner. The Nmap machine will be placed in the DMZ, configured with a local IP address and the network's Firewall as its default gateway.

VERSION #1.030

2. TEST

Step 1. Launch Nmap and configure it to scan a host address in the RNI. (Check the option do not ping on the Nmap GUI).

Step 2. Start the scan of the host.

Step 3. For the Nortel Firewall, observe the Tracker screen in the Checkpoint application on the CSMS. For the Juniper Firewall, observe the Traffic screen in the Netscreen Manager application on the CSMS.

Step 4. Verify that in Tracker/Traffic screen, all port scan attempts will be visually dropped, each entry will have a small red 'no entry' sign next to it and in the actions column the words 'dropped'.

Step 5. Observe the Sensor Analysis screen in the Site Protector console whilst ensuring the Sensors folder is selected in the Site Protector explorer bar.

Step 6. Verify that in the Sensor Analysis screen, log entries are seen pertaining to the port scanning taking place in the DMZ.

Pass____ Fail____

5.1.7.2 Intrusion Detection - Vulnerability Scan

1. DESCRIPTION

The network is configured with an Intrusion Detection Sensor. This test will use a vulnerability scanner to simulate various scans and attacks of a host in the DMZ.

NESSUS is a vulnerability scanner; the checks it runs are actual 'hacks' and can cause denial of service conditions. Under NO circumstances is it recommended to run NESSUS against a host address WITHIN the RNI or from within the RNI itself. Both NESSUS and NMAP should be run in the DMZ only to prove firewall and IDS functionality. Neither tool should be used DIRECTLY against RNI hosts/servers or transport infrastructure.

SETUP

This test will require a machine running Linux and loaded with the NESSUS vulnerability scanner. Place the NESSUS machine in the DMZ with a local IP address. The default gateway is not important because it will be scanning a local host address.

Note: A full NESSUS scan may take a significant amount of time to complete. It is not unusual for a full scan to take hours to complete depending on the number of nodes it detects.

VERSION #1.020

2. TEST

Step 1. Launch NESSUS and ensure to check the program option "enable all but dangerous plug-ins".

Step 2. Select the target as a local address within the DMZ, for example the internal IP address of the DMZ switch. The Firewall address in NOT recommended.

Step 3. Start the scan of the host.

Step 4. Observe the Sensor Analysis screen in the Site Protector console whilst ensuring the Sensors folder is selected in the Site Protector explorer bar.

Step 5. Verify that entries will be logged at various levels of severity, as NESSUS runs through its vulnerability scans.

Step 6. Terminate the NESSUS scan after a couple of events of varying levels of severity have been captured at the Site Protector console. Note: A full NESSUS scan may take a significant amount of time to complete. It is not unusual for a full scan to take hours

.

Pass____ Fail____

5.1.7.3 Virus Protection (Symantec Endpoint Protection)

1. DESCRIPTION

The network clients in the system are protected by anti-virus software. In this test, a mock virus will be introduced to the system. This test virus was developed by the European Institute for Computer Anti-Virus Research (EICAR) to provide an easy and safe way to test whether the anti-virus software is working, and see how it reacts when a virus is detected. This is a 70-byte file, which if executed, simply displays the message: "EICAR-STANDARD-ANTIVIRUS-TEST-FILE!"

SETUP

Acquire the EICAR test virus file (http://www.eicar.org/anti_virus_test_file.htm), and place it on a removable media drive.

VERSION #1.000

2. TEST

Step 1. Open the Symantec Endpoint Protection Manager Console on the CSMS server.

Step 2. Select the Monitors icon from the left side of the console and select the Logs tab.

Step 3. From the Log Type drop down box select Risk. For the time range use Past 24 hours. Press the View Log button.

Step 4. If not already set change auto refresh rate to 30 seconds this is located in at the top right corner of the Risk Log.

Step 5. Insert removable media with the EICAR test virus on a dispatch or network client. Attempt to execute the EICAR test virus.

Step 6. Open the Endpoint Protection Console on the client computer and select the View Logs button.

Step 7. Select the View Logs button for Antivirus and Antispyware Protection and select the Risk log. Verify that the triggered virus event information is stored in the log.

Step 8. From the CSMS Verify that the Risk Log updated since step 5 and that the triggered virus event information is stored in the Risk log.

Pass____ Fail____

5.1.8 Radio Control Manager (RCM) Features

5.1.8.1 Dynamic Regrouping

1. DESCRIPTION

Dynamic Regrouping allows the RCM to assign individual radios operating in different talkgroups to a temporary talkgroup via the Regroup command. Network managers or supervisors can override individual radio talkgroup selections by steering regrouped subscribers to a new talkgroup containing users which need to communicate on a temporary basis. After receiving a Regroup command, a radio will ignore the current setting of the talkgroup selector and move to the target talkgroup specified in the Regroup command. Unless the supervisor issues a LOCK command, the radio user can deselect the target talkgroup by selecting another talkgroup using the radio selector. A unique location on the radio selector is reserved for the target talkgroup following a Regroup command.

Dynamic Regrouping assignments can be initiated rapidly, but not instantaneously. Regrouping is best suited for planned activities or occasional changes from normal routines. It is not intended for immediate responses such as highspeed chases or for a rapid deployment on a per incident basis.

Regrouped radios receiving a second Regroup command will move to the new target talkgroup specified in the second command. When a regrouped radio receives a Regroup command, all information pertaining to the previous Regroup command is lost. A Cancel Regroup command or a Revert returns an individual radio to its normal operation.

Note - RCM user must be attached to primary and target talkgroup.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 1
RADIO-2 - SITE - SITE 2
RADIO-3 - TALKGROUP 2
RADIO-3 - SITE - SITE 3
RADIO-4 - TALKGROUP 2
RADIO-4 - SITE - SITE 4

VERSION #1.060

2. TEST

Step 1. With the RCM open from the Commands menu item select the Radio Commands item to open the command window. Choose Regroup.

Step 2. Enter TALKGROUP 3 in the target field.

Step 3. Enter the IDs or aliases of RADIO-1, RADIO-2, RADIO-3 and RADIO-4.

Step 4. Once all desired radio information is entered and appears in the command window click the Regroup button to initiate the command.

Step 5. Observe all radios are regrouped and are able to communicate on TALKGROUP 3.

Step 6. Switch the Subscriber to the Dynamic Regroup channel to acknowledge the group request.

Step 7. Observe that the radios are able to select different talkgroups and are not locked onto the regrouped mode. Note- The Talkgroup selector knob has to be set to the dynamic regroup position before switching to any other talkgroup.

Step 8. Observe that the Regroup task appears in the Command Monitor window.

Step 9. Issue a Selector Lock command all four radios and verify their selectors have been locked.

Step 10. Revert both commands and verify the radios have returned to normal operation.

Pass____ Fail____

Radio Control Manager (RCM) Features

5.1.8.2 Emergency Alarm Display

1. DESCRIPTION

The emergency call information that is displayed on the Radio Control Manager (RCM) includes the radio alias of the radio that initiated the Emergency Alarm, the talkgroup that the radio was affiliated to at the time the alarm was sent, and the time the alarm was received.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 1
RADIO-2 - SITE - SITE 2

One RCM is required which has TALKGROUP 1 attached to it.

VERSION #1.100

2. TEST

Step 1. Open the Radio Control Manager (RCM) windows and verify that the Emergency Alarm window is visible. If it is not, go to the View menu and select it bringing it into the RCM viewable area.

Step 2. Initiate an Emergency Alarm from RADIO-1.

Step 3. Observe that the RCM receives the Emergency Alarm.

Step 4. Acknowledge the Emergency by selecting the Emergency in the window and clicking on the Respond button.

Step 5. Verify the window displays the radio alias, the talkgroup, and the time the alarm was received.

Step 6. Again, select the displayed Emergency and click the Delete button to clear the emergency.

Step 7. Reset the radio by holding the Emergency button until the radio clears.

Step 8. Repeat Steps 1-7 using RADIO-2.

Pass____ Fail____

5.1.8.3 Radio Check

1. DESCRIPTION

Radio Check is a RCM command used to verify that a radio is active in the trunking system. The Radio Check command causes the Zone Controller to poll for the radio requesting that the radio re-affiliate. When the radio re-affiliates, the RCM then has the knowledge that the radio is powered on and within system range. If the radio is involved in a conversation, whether group or interconnect, the RCM application displays a message to that effect.

The information displayed by the RCM in response to the Radio Check command is: current talkgroup affiliation, the multigroup that the talkgroup is attached to (assuming the talkgroup belongs to a multigroup), and the site where the radio is affiliated. If the radio does not respond to the Radio Check command, a message to that effect displays.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast
RADIO-2 - TALKGROUP 1
RADIO-2 - SITE - SITE 2

VERSION #1.100

2. TEST

Step 1. Select the Command menu and then select the Radio Check item to open the Radio Check window.

Step 2. Enter the ID or alias of RADIO-2 into the entry box and click the Apply button.

Step 3. Observe the radio is polled and the current radio information is displayed on the RCM.

Step 4. Turn off RADIO-1.

Step 5. Enter the ID or alias of the RADIO-1 into the entry box and click the Apply button.

Step 6. Observe that the RCM displays "Radio Not Found."

Step 7. Depress and hold the PTT button of RADIO-2 until instructed to release.

Step 8. Enter the ID or alias of RADIO-2 into the entry box and click the Apply button. Observe that a busy for the radio is displayed on the RCM.

Step 9. Release the PTT button on RADIO-2.

Step 10. Observe the radio is polled and the current radio information is displayed on the RCM.

Pass____ Fail____

5.1.8.4 Radio Status

1. DESCRIPTION

This optional feature allows the Radio Console Manager to view status information sent in by subscribers. Statuses are used to indicate the Radio operator's operational state (e.g. off duty). The information that will be displayed includes the radio alias, talkgroup alias, hour and minute time stamp, status number or message number, and the customer entered translation for the specific status. Status input is displayed in chronological order, independent of the type of status number.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast

* Configure RADIO-1 in the manager to use a particular status set.

* Configure the assigned status set (via the status set manager configuration objects) to include text translations for a few different statuses.

* The RCM user needs to be assigned the dispatch attachment group that matches the radio user's assigned dispatch attachment group.

VERSION #1.020

2. TEST

Step 1. Initiate a Status transmission from RADIO-1.

Step 2. Verify the RCM displays the proper Status text.

Pass____ Fail____

Radio Control Manager (RCM) Features

5.1.8.5 Selective Radio Inhibit

1. DESCRIPTION

The INHIBIT command issued by the Radio Control Manager (RCM) disables a radio, preventing it from transmitting or receiving any audio. All of the radio's functionality ceases while a radio is inhibited by the RCM. Once inhibited, the radio cannot be used to monitor voice channels or for any other radio user initiated activity. Note that an inhibited radio still monitors the control channel so that it can be re-enabled with the Cancel Inhibit command. Upon receiving the Cancel Inhibit command from the RCM, the radio returns to its normal operation.

SETUP

RADIO-1 - TALKGROUP 1
RADIO-1 - SITE - Simulcast

VERSION #1.060

2. TEST

Step 1. From the Radio Control Manager select the Commands menu and then select the Radio Commands item in the menu to open the Command Window.

Step 2. Enter the IDs or aliases of RADIO-1.

Step 3. Select "Selective Inhibit" from the command pull down menu.

Step 4. Once all desired radio information is entered and appears in the command window click the submit button to initiate the command.

Step 5. Observe RADIO-1 is inhibited and appears to be dead.

Step 6. Observe that the Inhibit task appears in the Command Monitor window.

Step 7. Cancel the Inhibit by selecting the task in the Command Monitor window and clicking the Revert button to submit the task.

Step 8. Observe that the Cancel Inhibit task appears in the Command Monitor window and that RADIO-1 is returned to normal operation.

Pass____ Fail____

5.1.9 Report Generation Tests

5.1.9.1 Historical Reports

1. DESCRIPTION

Performance reports can be created automatically for dynamic statistical information about the air traffic activity on the system. These reports provide assistance with system management, resource planning, usage allocation, and monitoring. All reports are preformatted and summarize air traffic activity for a configured time span.

Note: Depending on the time span selected smaller time intervals may not be available.

SETUP

No prior setup is required for this test.

VERSION #1.110

2. TEST

Step 1. From the PC Application Launcher, select a zone.

Step 2. From that zone's menu, choose Zone Historical Reports.

Step 3. From the Historical Reports Player window that opens, select a report.

Step 4. Using the left mouse button, click on the view button.

Step 5. Observe a window opens allowing a user to enter report parameters.

Step 6. Enter all desired data for the report and Generate Report.

Step 7. Observe a window appears showing the requested report.

Step 8. Close the report window.

Step 9. Run the following reports during testing: Talkgroup at Zone Summary; User at Zone Summary; Site Summary.

Pass____ Fail____

5.1.9.2 Unified Network Configurator (UNC) Reports - Device Inventory Report

1. DESCRIPTION

The Unified Network Configurator (UNC) reports allow the user to generate data summaries to view information from the UNC database. Once the report is run, the results can be viewed, printed, and exported. This test will run a report that provides the data for a specific device.

SETUP

If the UNC is not open, double-click the UNC shortcut (UNC) on the desktop, and a VoyenceControl client session will launch. When prompted, use the Login dialog box to login to the UNC using the appropriate username and password.

Note: The output format for the report will default to PDF. If a different output format for the report is desired it will need to be selected.

VERSION #1.040

2. TEST

Step 1. From the UNC launch page menu bar select the Tools menu and choose Report Advisor. (If needed log in with appropriate user name and password.)

Step 2. From the Report Advisor screen, select the "Inventory Reports" header to expand the drop down menu.

Step 3. Select the desired report to run, in this case select "Devices by Model" and choose "Run Report".

Step 4. Navigate through the available devices until the desired device is located, select the devices, in this case HP Procurve Switch, to generate a report specific to the device.

Step 5. Drill down further by selecting the model of the device. This should list each of the appropriate model devices found in the UNC.

Step 6. Select the "Disk" icon to save the report to the server. Select the file format for saving the report. (Not all formats will be viewable on the client. The appropriate application would be needed to view the saved file.)

Step 7. Select "Downloads" on the left side of the screen to expand the selection. Verify the report that was saved in the previous step is listed. If it was saved as a PDF it should be available to view on the NM client.

Step 8. View the generated report. (In some cases the user may need to temporarily allow pop ups on the browser) The report can be saved to the client by selecting "Save As" and applying the appropriate information for filename and location.

Step 9. Verify the generated report has appropriate information on the selected devices and that it can be saved to the client.

Pass____ Fail____